

MUHAMMAD HARIS ZAFAR

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EDUCATION

Quaid-e-Azam University (QAU)

MPhil in *Physics*

Oct 2023 - Dec 2025

National University of Sciences and Technology (NUST)

Bachelor of Science in *Physics*, CGPA: 3.06 / 4.0

Sept 2018 – June 2023

RESEARCH EXPERIENCE

A Study of 1D Anyonic Hubbard Models

Supervisor: Dr. Axel Pelster

October 2025 - Ongoing

Studying the theoretical implications of the Anyonic Hubbard Model to provide a rigorous description of recent experimental realizations regarding exotic fractional statistics.

QPTs in Bose-Hubbard Models (MPhil Thesis)

Supervisor: Dr. Kashif Sabeeh

August 2024 - September 2025

Theoretical and numerical study of quantum phase transitions in standard, extended, and cavity-mediated Bose-Hubbard models, including long-range interactions and dissipative dynamics.

Electronic Goos-Hanchen Shift in jacutingaite

Supervisor: Dr. Muzammil Shah

July 2025 - December 2025

A mesoscopic study of the electronic equivalent of the optical Goos-Hanchen Shift in a tri-layer material. Manuscript submitted to Journal of Applied Physics.

Generalised Rotating Wave Approximation for Arbitrarily Large Coupling

Presented to: Condensed Matter Theory Group at QAU

Summer 2024

I thoroughly reviewed and reproduced theoretical work on the generalized rotating wave approximation by Irish (2007), including but not limited to numerical and analytical calculations. This project was presented to the Condensed Matter Theory Group at QAU.

DFTB Calculations using PythTB

Supervisor: Dr. Quratulain, Summer Project

Summer 2023

We studied the implementation of Density Functional Tight Binding (DFTB) to simpler lattice structures accompanied by calculations employing a Python package: PythTB. Additionally, I completed a Coursera course on DFT focusing on functional theory.

Soft-Collinear Effective Theory (Bachelor's Final Year Project)

Supervisor: Dr. Saadi Ishaq, Senior Year Project

September 2022 - June 2023

I studied the use of SCET as an Effective Field Theory for certain experiments in QCD. Strategy of Regions was employed to achieve cutoff regularisation to renormalize the theory at the soft-collinear momentum scales.

DFT Calculations using Quantum Espresso

Supervisor: Dr. Quratulain, Summer Project

Summer 2022

I studied the key ingredients to Density Functional Theory and DFT calculations using QE. Implementation on a remote parallel computing facility at NUST.

SKILLS

Quantum Computation: Qiskit *by* IBM, Qutip, TeNPy

Programming: C, Python, Numerical Analysis with Python, LaTeX.

Software: Jupyter Notebooks, Google Collab, Microsoft Office Suite, Google Workspace.

COMPUTATIONAL WORK

<https://github.com/HarisZafar505>

- Use and implementation of White's DMRG for calculations to my 1D Bose-Hubbard. Summer 2025
- Monte-Carlo Simulations for spin systems and more as a part of a graduate course in Statistical Physics. Fall 2024
- Numerical and Graphical Implementation to the extended Jaynes-Cummings Spectrum. Summer 2024
- Numerical and Graphical Implementation to tight-bonding models. Summer 2023
- Parallel-Computing using remote clusters at SINES, NUST Summer 2022

LEADERSHIP ROLES

VP- Welcome 2019, *SNS Student Club (SSC) Sept 2019 - Nov 2019

- Successfully coordinated a Welcome Party for the incoming freshman cohort and faculty members in my role as Vice President of Media for the School of Natural Sciences..

YLC-2019 Participant July 2019

- Attended the week-long residential Youth Leadership Conference in Lahore, Pakistan.

The Discussion Corner (Founder) Nov 2019 - Present

- I founded The Discussion Corner along with a fellow classmate. The purpose of this platform is and has been to promote free speech and discourse pertaining to philosophical, social, and scientific problems.

TEACHING

Diploma of Associate Engineering Instructor, NUTECH, Islamabad September 2025 – Present

- Recently joined in the capacity of an instructor of a technical degree program for Applied Physics.

Edbit Digital Tutors July 2020 – Present

- I have had the privilege of teaching physics and mathematics to high school students. I have taught many curriculums: the British, Irish, and American (AP) curriculums.
- I have integrated modern tools and an interactive learning environment along with graphical and mathematical tools for visualization.

Teaching Assistant (TA) Spring 2025

- I gave tutorial lectures (one per week) and prepared problem sets on the course: Calculus and Analytical Geometry - II.

Community Service Project March 2023 - April 2023

- Provision of Digital Resources to an Orphanage and an Underprivileged Community School. Projectors and a small-scale computer lab were built.

GRANTS AND FELLOWSHIPS

Pakistan Science Foundation, Science Talent Farming Scheme 2017-2023

- STFS is an initiative by the PSF for talented young individuals to pursue pure sciences. Monthly Stipend and tuition costs were covered under this program.

National Physics Talent Contest, Camp 1 and 2 2017

- NPTC organizes selections and training weeks for prospective IPhO (International Physics Olympiad) participants.