Zeest Fatima

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EDUCATION

University of Waterloo **Sept 2020 – Dec 2025**
Candidate for BSc, Honors Mathematical Physics with a minor in Pure Mathematics *Waterloo, Ontario*

SUMMARY OF QUALIFICATIONS AND SKILLS

- Programming experience: **C#**, **Python (scikitlearn, pytorch, pandas, numpy, matplotlib, plotly), Maple, Linux OS** and **LaTeX**, web development through **Flask** and **Plotly**.
- **Simulation software**: nextnano (finite element Poisson solver), QuDiPy (python library for simulating electron dynamics in quantum dots).
- Analog electronics, circuit design and soldering: implemented pressure and temperature sensors using a **Raspberry Pi**. Worked with **silicon photomultipliers**, **scintillators,** a **fast-pulsed laser** and a **time-to-digital converter (TDC)**.
- Mechanical design/ fabrication: **AutoDesk Inventor** and **SolidWorks**.
- Image processing experience: volume analysis on TIFs using **Fiji ImageJ** and **Avizo**.
- Experience with academic writing: undergraduate thesis, lab reports, also see **Publications**.

PUBLICATION(S) AND PRESENTATION OF RESEARCH (viewable on GitHub)

Kaminski, P., Grabe, J., & Fatima, Z. (2023). Miniaturised testing device for the qualitative analysis of gas exsolution in soil. Proceedings Paper, OMAE2023-101605, V009T10A014. https://doi.org/10.1115/OMAE2023-101605

Undergraduate thesis (Phys 437A and B): Characterizing Disorder in the Electrostatic Potential Landscape of Quantum Dot Devices Using Machine Learning

Research Report, Calculus of Variations (Amath 456): Optimal Control in Diffusion Models

WORK EXPERIENCE

Undergraduate Thesis, **September 2024 – Present**
Institute for Quantum Computing

Thesis topic: Quantifying disordered potentials in Quantum Dot devices using ML
*thesis completed, working as a volunteer on the project currently

Did an undergraduate thesis under Prof. Jonathan Baugh on locating charge defects in the electrostatic potential landscapes of silicon-spin qubit quantum dot devices using Machine Learning. Specifically, using a Convolutional Neural Network on charge stability diagrams and Support Vector Machine on engineered parameters (on data acquired from simulations).
After completion of the thesis, I have continued to volunteer on the project, with the goals of: 1) reducing data generation time while ensuring the model outputs physically-relevant results, 2) implementing a Mixture-Density Network head onto the CNN so that the model outputs a probability distribution over possible defect cases, rather than identifying a single unique defect characterization.

ISAC High Energy Proton Irradiation Research Assistant, **September 2023 – August 2024**
TRIUMF

The project aimed to develop experimental tools for measuring the temperature of various components of ISAC (Isotope Separator and Accelerator) targets during high energy proton irradiation.

- Developed a **real-time temperature logging system** for the ISAC target conditioning test stand using a **Raspberry Pi** and a **signal amplifying ADC** for accurate temperature measurements.
- Utilized the Raspberry Pi data acquisition system to perform high voltage tests in the test stand, to test out spark mitigation components.
- Implemented a spark mitigation and noise reduction system on-line, using diodes, ferrites, and an isolation amplifier, to enhance the performance of thermocouples under high proton irradiation.
- Employed **Python's Pandas** and **Matplotlib** libraries for data analysis. Analyzed data from five on-line thermocouple test runs, including recent term experiments.
- Worked on understanding the proton beam's charge deposition effect on the thermocouples through data analysis.

Ultra-fast Time-of-Flight Neutron Spectrometer for General Fusion, TRIUMF **May 2024 – August 2024**

Tested out various components of a time-of-flight neutron spectrometer, meant to measure energies of the neutrons released during D-D nuclear fusion for General Fusion's LM-26 magnetized-target fusion machine. Worked with silicon-photomultipliers, scintillators and an ultra-fast time-to-digital converter.

- Wrote code to test various amplifiers with selected **Silicon Photo Multipliers (SiPMs)**, with the goal of reducing the output pulse's period and increasing its amplitude. Did all data acquisition through **time-to-digital converters (TDCs).**
- Tested various properties of our SiPMs including effects of various applied overvoltages on dark noise counts, investigated **single photon timing resolution** using different amplifiers with a **fast-pulsed laser**, looked at dark rate count with and without a **scintillator**, as well as other tests.
- Created a webserver through python and flask that can be used to conduct all my analysis and easily plot some of the plots that I plotted. Also documented all my analysis code on a GitHub repository.

Research Assistant for Experimental Soil Mechanics in Marine Geotechnics, Technische Universitaet Hamburg-Harburg, **Sept 2022 – April 2023** **Hamburg, Germany**

- Conducted a research project investigating the behavior of gas in saturated soil pore spaces.
- Designed and developed a pressurized test stand and implemented analog temperature and pressure sensors to it using the Raspberry Pi 4.
- Utilized **SolidWorks** and **Autodesk Inventor** to design and 3D printed multiple prototypes to optimize the test stand's design.
- Wrote a **C#** interface to control a GDS standard pressure controller, added additional features to the interface to optimize it for calibration procedures, and then used the pressure controller to calibrate the analog pressure sensors.
- Analyzed the data acquired during the calibration procedure using **Python** (**pandas**, **numpy**, and **matplotlib**) to calibrate the sensors.
- Conducted CT scans of the test stand to optimize scan settings for optimal results.
- Used **Avizo** and **Fiji ImageJ** to image process the CT data and created an optimized recipe for volume processing of the soil to study pore spaces and surface interactions between soil, water and air.
- **Published** a conference proceedings **manuscript** for ASME 2023.