Shah Saad Alam

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Education

Rice University, TX
Ph.D Physics *2017 – 2022*
Thesis: *Quantum Spinor Gases: Universal Relations, Strong Interactions and Machine Learning Investigations*

Rice University, TX
M.S. Physics *2015 – 2016*
Theoretical and Computational Space Plasma

Amherst College, MA
Bachelors in Physics (Honors) and Mathematics *2010 – 2014*
Physics Honors Thesis: *"High Resolution Spectroscopy of TlF"*

JILA, Boulder
CU Boulder Summer School in Ultracold Physics *2021*
CU Boulder Ultracold Physics summer school for AMO and Condensed Matter

Skills

Programming: Python, C++, Modern C++, Rust, Programming Languages InterOp and FFI, Fortran, MATLAB, Mathematica, Java, Pytorch, Cirq, Tensorflow, SciPy, NetworkX, Anaconda, Git, Linux, High Performance Computing

Soft Skills: Mentorship, Project Management, Leading Collaborations, Public Speaking

Work Experience

Postdoctoral Research Associate **Jan 2023 – current**
JILA, University of Colorado, Boulder, CO, Holland Group
Quantum Computing, Reinforcement Learning (RL), Physics Informed Machine Learning

- Trained reinforcement learning models (DQNN) using Pytorch and Libtorch for optimizing design of quantum inertial sensors for future space deployment
- Designed Physics informed reinforcement learning models
- Wrote physics simulations of noisy quantum circuits and devices in Rust, Python and C++
- Wrote interoperability between Rust and C++ RL code
- Derived Bayesian statistical theory and information theory results
- Wrote quantum circuit code in Google Cirq for optimization using reinforcement learning
- Worked with experimentalists to simulate and optimize design of real hardware implementations
- Collaborated with scientists in academic and industry partners (Cleveland State, CU Boulder, Infleqtion)
- Gave scientific talks on research and wrote scientific publications

Graduate Research Assistant **2015 – 2022**
Rice University, TX
Convolutional Neural Networks and Variational Quantum Monte Carlo

- Collaborated with ML researchers to design physics informed interpretable convolutional neural networks (TensorFlow)
- Project managed a multi-institution collaboration by defining project outlines, goals and timelines
- Analytically connected Convolutional Neural Networks and information theory to quantum qubit problems
- Supervised junior physics and computer science students
- Analytically solved quantum qubit problems
- Gained familiarity with domain specific quantum algorithms and general matrix algorithms

Space Weather and Plasma Modelling, Data Analysis and Theory

- Wrote scripts in C++, Mathematica, MATLAB and Python codes to automate analysis of 25GB of data from Los Alamos National Lab's Van Allen Space Probes mission
- Derived mathematical theory for data drive physics simulation of space weather in the Earth's radiation belts
- Modified and ran space weather simulations on HPC cluster at Rice University using Rice's Radbelt Model
- Contributed code to a collaborative multi-institution codebase and simulation effort

Theoretical and Computational Study of Quantum Systems

- Wrote Python code and supervised three undergraduate projects to develop physics simulations (Python and Mathematica) and theory
- Derived analytical theories for quantum systems and their thermodynamics
- Analytically proved existence of unique phenomena in 1D quantum spin gases
- Gave talks on research at multiple conferences (APS March, DAMOP)
- Published one paper, writing another paper for publication
- Supervised undergraduate theses
- Developed algorithms and codes utilizing random matrix theory methods to solve quantum scattering problems
- Coauthored two papers on results from project

Teaching and Research Assistant **2014-2015**

Habib University, Pakistan

- Taught an "Introduction to Matlab" course for freshmen engineering students
- Wrote Matlab demonstrations of physics concepts for freshmen students

Professional Service

- Proposed and Chaired a DAMOP conference session on Quantum Theory and Machine Learning
- Worked with APS leadership to help start an APS chapter at Rice University
- Served as postdoctoral rep on JILA Fellow meetings

Selected Publications

For a full record of publications and conference talks, see Google Scholar Profile.

- "Interpreting convolutional neural networks' low dimensional approximation to quantum spin systems", Yilong Ju, **Shah Saad Alam** (Equal Contribution), Jonathan Minoff, Fabio Anselmi, Han Pu, Ankit Patel, arxiv::2210.00692 (Currently submitting)
- "Decorrelated, Robust Approach to Multi-Parameter Quantum Sensing" **Shah Saad Alam et al.** (currently in prep, joint collaboration with Infleqtion)

Leadership and DEI Advocacy Experience

2020-2022: Rice University Physics Department DEI committee

2019 – 2020: Director for International Student Outreach, Rice Graduate Student Association

References

- Murray Holland, Professor of Physics and JILA Fellow, CU Boulder, Murray.Holland@colorado.edu
- Han Pu, Professor of Physics and Astronomy, Rice University, hpu@rice.edu
- Kaden Hazzard, Professor of Physics and Astronomy, Rice University, kaden.hazzard@gmail.com
- Ankit B. Patel, Professor of ECE, Rice University, abp4@rice.edu