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Google Scholar Profile, Github

Shah Saad Alam

Education

2017 – 2022 **Ph.D Physics**, *Rice University, TX*.
Thesis: *Strongly Interacting Quantum Gases*

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

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

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

Skills

Physics	Theoretical and computational AMO, Quantum many body theory, Open quantum systems theory, Experimental AMO, Building optical setups, Spectroscopy
Technical	Python, C++, FORTRAN, MATLAB, Mathematica, Java, Pytorch, Cirq, Tensorflow, SciPy, NetworkX, Anaconda, Git,Jupyter Notebook, Linux, High Performance Computing, LaTeX
Basic Familiarity	Rust, FEM methods
Soft Skills	Project Management, Leading Collaborations, Public Speaking

Work Experience

Jan 2023 – **Postdoctoral Associate**, JILA, University of Colorado, Boulder, CO, Holland Group.
Quantum Computing, Open Quantum Systems and Machine Learning
- Wrote simulation codes using Reinforcement Learning and quantum trajectory theory to design quantum circuits for sensing, modelling them as open quantum systems susceptible to errors
- Did analytical theory for AMO projects
- Wrote code in Google Cirq, Pytorch, Python and C++ for various quantum systems
- Worked with experimentalists to do simulations and calculations for their project
- Writing C++ code to simulate physics in AMO optical lattice and laser experiments
- Collaborated with computer scientists from different institutions

2017 – 2022 **Graduate Research Assistant**, Rice University, TX.
Convolutional Neural Networks and Variational Quantum Monte Carlo
- Project managed a multi-institution collaboration by defining project outlines, goals and timelines
- Analytically connected Convolutional Neural Networks and information theory to 1D AMO spin-chain problems (paper in preparation, intend to submit to Science Magazine)
- Supervised junior physics and computer science students
- Analytically solved AMO spin systems
- Wrote Python code to solve different AMO Hamiltonians and compared different quantum algorithms

Theoretical and Computational Study of 1D AMO systems
- Derived analytical theories for 1D AMO systems and their thermodynamics
- Analytically proved existence of unique phenomena in 1D quantum spin gases
- Supervised three undergraduate projects to develop physics simulations (Python and Mathematica) and theory
- Gave talks on research at multiple conferences (APS March, DAMOP)
- Published one paper, writing another paper for publication
- Supervised undergraduate theses

Quantum Molecular Scattering Theory
- Developed codes and theory utilizing random matrix theory methods to solve dipolar molecular scattering
- Derived analytical theory results for dipolar molecules in optical lattice systems
- Coauthored two papers on results from project

2015 – 2017 **Graduate Research Assistant**, Rice University, TX.
Theoretical and Computational Space Plasma
- 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 relevant equations for the simulation
- Modified and ran space weather simulations on HPCC at Rice University using Radbelt
- Improved an existing codebase through collaboration with three institutions

2014 – 2015 **Teaching and Research Assistant**, Habib University, Pakistan.

2011 – 2014 **Undergraduate Research Assistant**, Amherst College, MA.
Laser Cooling TlF
- Designed and built experimental lasers optics systems for AMO and spectroscopy
- Wrote LabVIEW code to automate the experiment setup and modifications
- Conducted single photon counting and spectroscopy experiments
- Co-authored two papers on results from this experiment

Professional Service

- Proposed, invited speakers and chaired a DAMOP Focus session while a graduate student
- Worked with APS leadership to help start an APS chapter at Rice University

Publications

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

2022 Li Yang, **Shah Saad Alam**, and Han Pu. *Generalized Bose–Fermi mapping and strong coupling ansatz wavefunction for one dimensional strongly interacting spinor quantum gases*. *Journal of Physics A: Mathematical and Theoretical*, volume 55, page 464005. IOP Publishing, nov 2022.

2022 Yilong Ju, **Shah Saad Alam (co-first author)**, Jonathan Minoff, Fabio Anselmi, Han Pu, and Intended Submission to Science Ankit Patel. *Interpreting convolutional neural networks' low dimensional approximation to quantum spin systems*. *arxiv: 2210.00692, Intended Submission to Science*, 2022.

2021 **Shah Saad Alam**, Timothy Skaras, Li Yang, and Han Pu. *Dynamical Fermionization in One-Dimensional Spinor Quantum Gases*. *Physical Review Letters*, volume 127, page 023002. APS, 2021.

2017 Michael L Wall, Rick Mukherjee, **Shah Saad Alam**, Nirav P Mehta, and Kaden RA Hazzard. *Lattice-model parameters for ultracold nonreactive molecules: Chaotic scattering and its limitations*. *Physical Review A*, volume 95, page 043636. APS, 2017.

2017 Michael L Wall, Nirav P Mehta, Rick Mukherjee, **Shah Saad Alam**, and Kaden RA Hazzard. *Microscopic derivation of multichannel Hubbard models for ultracold nonreactive molecules in an optical lattice*. *Physical Review A*, volume 95, page 043635. APS, 2017.

2017 Eric B Norrgard, Eustace R Edwards, Daniel J McCarron, Matthew H Steinecker, David DeMille, **Shah Saad Alam**, Stephen K Peck, Neha S Wadia, and Larry R Hunter. *Hyperfine structure of the $B^3\Pi_1$ state and predictions of optical cycling behavior in the $X \rightarrow B$ transition of TlF*. *Physical Review A*, volume 95, page 062506. APS, 2017.

2012 LR Hunter, SK Peck, AS Greenspon, **S Saad Alam**, and D DeMille. *Prospects for laser cooling TlF*. *Physical Review A*, volume 85, page 012511. APS, 2012.

Leadership and DEI Advocacy Experience

2020 – 2022 **Rice University Physics and Astronomy Dept**, *Graduate Representative for DEI Committee*.
- Collaborated with committee members on developing long term policy goals, metrics and gathering data for the Department's DEI goals

2019 – 2020 **Rice Graduate Student Association**, *Director for International Student Outreach*.
- Member of Rice Graduate student government working on issues related to international student advocacy

2018 – 2019 **Rice Physics Graduate Association**, *Vice President*.

2018 – 2018 **Rice Pakistan Students Association**, *Treasurer/Co-founder*.

References

- 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
- Murray Holland, Professor of Physics and JILA Fellow, CU Boulder, Murray.Holland@colorado.edu
- Ankit B. Patel, Professor of ECE, Rice University, abp4@rice.edu