Benjamin Safvati

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Education

Ph.D in Physics - Stanford University 2019 - 2024
◇ Doctoral Thesis: *Atomic-Scale Manipulation and Modeling of 2D Quantum Systems.* Advisors: Hari Manoharan and Trithep Devakul.

Bachelors in Physics with Mathematics Minor - UC Berkeley 2015-2019
◇ Senior Thesis: *Topological Phases and the Negative Sign Problem in Neural-Network Quantum State Simulation.* Advisor: Joel Moore.

Professional Experience

Doctoral Student Researcher - Multi-scale Simulations of 2D Materials 2023-2024
Devakul Group, Stanford University

◇ Designed numerical and analytical models of mesoscopic electronic physics in twisted multilayer materials to predict and characterize novel phases of matter.
◇ Performed parallelized simulations on computing clusters to efficiently sample material parameters.
◇ Compared the accuracy of effective models in describing lattice dynamics and many-body correlations.

Doctoral Student Researcher - Atomic-scale Electronic Imaging 2019-2023
Manoharan Lab, Stanford University

◇ Operated and maintained a custom-built scanning tunneling microscope (STM) with low-noise electronics and vibration isolation to image and manipulate surfaces of exotic materials.
◇ Statistically analyzed STM data and developed theories to explain experimental observations.
◇ Prepared quantum-mechanical simulations to motivate experimental design of atomic nanostructures.
◇ Maintained a facility for reliquefying gaseous helium from cryostats with recycling rates of up to 90%.
◇ Coordinated with synthesis and fabrication partners to prepare novel 2D material samples for STM.

Undergraduate Student Researcher - Diamond Spintronics 2017-2019
Pines Lab, UC Berkeley

◇ Part of a team that built a NMR system with integrated laser and RF excitation to investigate polarization transfer and spin relaxation mechanisms of defects in diamond.
◇ Designed algorithms to efficiently process experimental data and optimize sample growth parameters.
◇ Programmed control software with microsecond device synchronization to minimize signal loss.
◇ Engineered portable devices for NMR signal enhancement and field tested them on external devices.
◇ Mentored 10+ student researchers from diverse STEM backgrounds, and conducted hiring interviews.

Technical Skills

Experimental Methods: Laboratory electronics (lock-in amplifiers, spectrum analyzers, feedback controllers, waveform generators), cryogenics (liquid nitrogen and helium), ultra-high vacuum equipment, clean-room preparation of vacuum-safe materials, optics design, laser alignment, soldering, spot welding.

Programming Languages: Python, MATLAB, Julia, C, Labview, SQL (MySQL).

Visual Design: Adobe Illustrator, AutoCAD, LaTeX, HTML, Houdini.

Other Software Skills: Density functional theory simulation of materials (VASP, pymatgen, Quantum Espresso), machine learning (Pandas for data processing, Scikit-learn and Pytorch for statistical modeling), Slurm, Git.

Awards

◇ **Paul Kirkpatrick Teaching Award, Winter 2023.**
Awarded to those who have demonstrated a commitment to the teaching of physics to undergraduates.

Scientific Talks

◇ **Macroscopic Quantum Tunneling Devices for Nanoscale Attonewton Force Sensing**

APS March Meeting 2020, Denver, CO

Publications

1. C. Z. Zerger *et al.* "Nanoscale Electronic Transparency of Wafer-Scale Hexagonal Boron Nitride." Nano Lett. 2022, 22, 11, 4608–4615. [arXiv:2109.01522]

2. A. Ajoy, **B. Safvati**, *et al.* "Hyperpolarized Relaxometry Based Nuclear T1 Noise Spectroscopy in Diamond." Nature Communications, vol. 10, no. 1, 2019. [arXiv:1902.06204]

3. A. Ajoy *et al.* Orientation Independent Room-temperature Optical ^{13}C Hyperpolarization in Powdered Diamond, Science Advances, 4, eaar5492, 2018. [arXiv:1806.09812]

4. A. Ajoy *et al.* "Enhanced Dynamic Nuclear Polarization via Swept Microwave Frequency Combs," Proceedings of the National Academy of Sciences, 1807125115 (2018). [arXiv:1807.07664]

5. A. Ajoy, *et al.* "Wide dynamic range magnetic field cycler: Harnessing quantum control at low and high fields," Review of Scientific Instruments 90, 013112 (2019). [arXiv:1808.10579]

6. A. Ajoy *et al.* "Room temperature Optical Nanodiamond Hyperpolarizer: physics, design and operation," Review of Scientific Instruments 91, 023106 (2020); [arXiv:1811.10218]