Akshay Shankar

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Research Interest: *Investigating the exotic phases of ultra-cold matter using numerical simulations.*

Education

Indian Institute of Science Education and Research (IISER), Mohali — *Punjab, India*

BS-MS Integrated degree (Major in Physics and Minor in Data Science) — *Aug. 2018 - May. 2023 (expected)*

- **CPI: 9.96/10** (till 8th semester)
- INSPIRE SHE (Scholarship for Higher Education) recipient, 2018-2023

Skills

Scientific Programming Julia, Python, Fortran90, C++
Front-end development HTML, CSS, JavaScript
Other software Blender (3D modelling), GAMESS (Quantum Chemistry)

Experience

Master's thesis with Dr. Sanjeev Kumar, in collaboration with Prof. Dr. Tilman Pfau — *IISER Mohali | University of Stuttgart*

Julia, Python — *June 2022 - Present*

- Implemented quantum many-body algorithms (MFT, CMFT) to qualitatively predict the exotic phases exhibited in the 2D - Bose Hubbard Model.
- This was done to assist the planning of an experimental quantum simulator setup using an optical lattice loaded with dipolar dysprosium atoms.
- Currently continuing this work by implementing Quantum Monte Carlo (QMC) algorithms to precisely locate the phases of the system.

Research Internship with Dr. Vishwanath Shukla — *IIT Kharagpur (Remote)*

Julia, Fortran90 — *May 2021 - Aug. 2021*

- Explored concepts of parallel computing by learning elementary MPI and OpenMP.
- Read about superfluidity in BECs and implemented methods to simulate the 1D GPE to study ground state dynamics in harmonic traps.
- Continued to develop an interest in supersolidity in dipolar BECs and attempted to simulate the system.

Research Internship with Dr. P. Balanarayan — *IISER Mohali (Remote)*

Python (NumPy, SciPy) — *May 2020 - July 2020*

- Explored simulation methods to study the behaviour of 1D quantum wave packets in a potential.
- Implemented algorithms to solve the time (in)dependent schrodinger equation and perform transfer matrix-based calculations to study scattering from potential barriers.

Research Internship with Dr. Prafulla Kumar Behera — *IIT Madras*

ROOT (C++ framework) — *May 2019 - July 2019*

- Learnt elementary particle physics and neutrino detection methods.
- Worked with the analysis tool ROOT to study various aspects of the muon response of the Indian Neutrino Observatory's ICAL detector using simulated data.

Other Projects

The Physics Hub — *Remote*

HTML, Javascript — *May 2020 - June 2021*

- Helped set up and develop content for an open source repository hosting interactive physics simulations.
- Created by the cumulative effort of a group of undergraduates across various STEM disciplines.
- Currently not being actively maintained, but served as a great experience in working as part of a team.

Term Project for PHY312 (Advanced electronics and instrumentation lab) — *Remote*

COMSOL Multiphysics — *June 2021 - July 2021*

- Studied the piezo-electric effect exhibited by PVDF and PZT materials under different types of mechanical loads using COMSOL simulations.

Misc. Simulations & Animations - [LINK] — *Remote*

Python, Julia, Javascript — *May 2020 - Present*

- A collection of various physics simulations and GIFs made over the course of my summer research projects and coursework.

Awards & Achievements

2022	**1st Place**, Enigma, AstraX'22 - Machine Learning based Hackathon to solve problems in Astrophysics.	*IIT Mandi*
2019-22	**Certificate of Academic Excellence**, in semesters 3, 4, 5, 6, and 7 for obtaining 10.0 SPI	*IISER Mohali*
2019	**CNR Rao Foundation Award**, for obtaining 10.0 SPI in the 2nd semester.	*IISER Mohali*

Workshops & Conferences

2022	**Julia for High-Performance Computing**, 3.5-day hands-on course introducing HPC using Julia.	*HLRS, Stuttgart*
2022	**Qiskit Global Summer School (QGSS)**, a two-week summer program focused on Quantum Simulation.	*Remote*
2019	**Vijyoshi National Science Camp**, a 4 day lecture series on assorted scientific topics.	*IISER Bhopal*