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 - April. 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 under Dr. Sanjeev Kumar, in collaboration with Prof. Dr. Tilman Pfau — *IISER Mohali | University of Stuttgart*

Julia, Python — *June 2022 - Present*

- Implemented algorithms (MFT, CMFT) to qualitatively predict and identify 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 under Dr. Vishwanath Shukla — *IIT Kharagpur (Remote)*

Julia, Fortan90 — *May 2021 - Aug. 2021*

- Learnt and explored concepts of parallel computing by picking up basic MPI and OpenMP. Did not proceed with this due to lack of interest.
- Read about superfluidity in BECs and implemented simple algorithms to study ground state solutions and dynamics in trapping potentials.
- Continued to develop an interest in dipolar BECs and supersolidity, but not much progress was made.

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

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

- Explored simulation methods to study the behaviour of quantum wave packets under the influence of 1-dimensional potentials.
- Implemented algorithms to solve time (in)dependent Schrodinger equations and transfer matrix-based calculations to study scattering from potential barriers.

Research Internship under 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 **CNR Rao Foundation Award**, for obtaining 10.0 SPI in the 2nd semester. *IISER Mohali*

Workshops & Conferences

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*