

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

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

Workshops & Conferences

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