Nimish Sharma

IISER Kolkata | ns21ms184@iiserkol.ac.in | +91-9408916321 | LinkedIn | Github

About me

I am a fourth-year undergraduate student in Physics at IISER Kolkata with a strong passion for optics and experimental physics. Alongside my academic pursuits, I have developed significant expertise in computational physics and am eager to expand my skills into experimental material sciences. I thrive in collaborative environments and enjoy working in teams to solve complex scientific problems. Beyond academics, I am an avid football player and guitarist, always seeking a balance between analytical thinking and creative expression.

Reseach Interest

Material Science

- I aim to employ mathematical models for processing scientific data in the realm of experimental physics, particularly within the fields of Material sciences. I aim to develop and refine simulation models specifically tailored for analysing experimental data, seeking to unveil patterns that human researchers may not immediately recognise.
- With a foundational background in quantum computing, DFT, and MD, my goal is to extend this expertise to the domain of experimental physics. This interdisciplinary approach allows me to simulate and comprehend particle interactions and behaviours at a fundamental level, contributing to developing more effective experimental methodologies.
- I aim to extend my expertise in computational physics towards the experimental domain, specifically in optics and plasmonics. I aim to bridge the gap between theoretical simulations and practical implementations by leveraging computational tools to guide and refine experimental methodologies.
- I am particularly interested in studying light-matter interactions, spin-orbit coupling effects, and their applications in nano-optics. Through experimental investigations in plasmonics and metamaterials, I seek to develop advanced optical devices that can manipulate and harness light at the nanoscale. My current focus is on utilising the principles of spin-orbit interaction to design multifunctional nano-optical systems with potential applications in imaging, sensing, and communication technologies.
- By integrating computational modelling with hands-on experimentation, I aim to optimise material properties and develop novel photonic structures. The emerging field of bio-optics and its intersection with nanophotonics has also piqued my interest, and I am keen on exploring its applications in biomedical imaging and diagnostics.

Courses

- Advanced Electricity, Magnetism, and Optics
- Advanced Optics Laboratory
- Chemistry of materials
- Quantum Information Processing
- Biophysics II
- Condensed Matter Physics
- Field Theory and Relativistic Quantum Mechanics
- Introductory Astrophysics
- Condensed Matter Laboratory
- Numerical Analysis Methods - MATLAB
- Thermal Physics & Statistical Mechanics - I
- Quantum Mechanics - I, II, III
- Linear Algebra - I
- Programming and Data Structures in C
- Computational Physics
- Data Structures and Algorithms in C
- Classical Mechanics - I & II
- Quantum Chemistry
- Probability - I
- Spectrochemistry & Organic Synthesis Lab
- Applications of Thermodynamics
- Nuclear Physics Lab
- Optics and Modern Physics Lab
- Electronics Lab
- Artificial Intelligence
- Information Retrieval and Web Search

Education

Indian Institute of Science Education and Research Kolkata August 2021 – May 2026

- BS-MS in Physics along with a minor in Computer Science.
- **CGPA(Current) :** 7.97

Experience

Bio-Optics Lab | IISER Kolkata January 2025 - Present

- Joined a Bio-optics lab at IISER Kolkata to work on metamaterials and plasmonics.
- Conducting experimental research on optical properties of nanostructured materials.
- Investigating applications of plasmonic interactions for enhanced imaging and sensing technologies.
- Integrating computational modelling with lab-based experimentation to optimise material design and performance.

First Principle Investigations on Heusler Alloys | IAS SRFP – SVNIT Surat May 2024 – July 2024

- Basics of Density Functional Theory and solid state physics were studied to grasp the theoretical understanding. It included reading research papers on Heusler alloys to understand their properties and structure.
- To get familiarised and gain confidence with the DFT software (QE and WIEN2k), results were replicated from a paper on Ti2VGe and the half-metallic nature was confirmed.
- Proceeding from the success, further first principle calculations were performed for our chosen alloy. Structural optimisations, magnetic properties, elastic properties, dynamical stability and electronic properties were calculated.
- Finally, I compiled and submitted a report detailing DFT theory, software usage, and findings to the Indian Academy of Sciences.

Quantum Machine Learning | Summer Internship – IISER Bhopal May 2023 – July 2023

- Quantum Computing basics, including introduction to quantum gates, entanglement, quantum teleportation, and algorithms.
- Building a binary classifier for the Iris dataset by developing a Quantum Deep Learning Network.
- Tested the network on IBMQManila and compared its results with various Classical Machine Learning models such as Logistic Regression, KNeighbour and Decision Tree classifier.
- Creating a presentation and writing a report to conclude the results and learnings.

Integration of Payment Portal | Summer Project – IISER Kolkata May 2023 – July 2023

- Built an Integration for a Payment Gateway into the existing mess website for my Institute.
- Used Django framework and SQLite. Learned front-end webpage designing using CSS and Javascript.
- Finally, I wrote a report concluding the work and things learned during the project.

Workshops

Physics through Computational Thinking | NPTEL – IISER Bhopal Feb 2023 - April 2023

- Wolfram Alpha and Fortran programming language.
- Introduction to Monte-Carlo Simulations and simulating statistical models.
- Application of Numerical Methods (Euler, Runge Kutta(2,4), etc.)

From Atoms to Materials: Predictive Theory and Simulations | edX – Purdue University December 2023

- Relating the application of Classical Mechanics, Quantum Mechanics and Statistical Mechanics to the Real World.
- Online DFT and running MD simulations(on NanoHub) on basic molecules and predicting their thermal and electronic properties.

Lunar Exploration through Artificial Intelligence | Spartificial May 2022 - June 2022

- Introduction to various Unsupervised Machine Learning Algorithms.
- It also familiarised me with techniques like classification, clustering, and different state-of-the-art machine learning models like ResNet.
- The platform used was Kaggle.

Winter School for Quantum Computing | IISER Kolkata December 2022

- Introduction to basic quantum gates and quantum algorithms. Discussion of the issue of decoherence of

quantum particles.

- Vast applications in the fields of medicine, finance, material sciences, etc.

Projects

Term Paper - Metasurfaces & Flat Optics Oct 2024 - Dec 2024

- Discussed the effect of the Optical Spin Hall effect and spin-orbit interaction in the domain of metasurfaces.
- Mathematically derived the effects of the gradient of refractive indices in an anisotropic medium, which leads to the fabrication of metasurfaces.
- Finally, I wrote and presented a term paper on the field review of metasurfaces and flat optics.

Library Management System January 2024

- Developed a Library Management system with a user and an admin login in C.
- Incorporated various features for the book records, such as searching, issuing, deleting, etc.
- Received an outstanding group assignment mention for the project.

LiFi 2020

- Built a working prototype for transmitting audio data through the light spectrum.
- Won various awards for it at the school level.

Bus Booking Portal using Python and MySQL Github

- Developed a bus booking portal using Python and MySQL as the DBMS.

Extra-Curricular

Summer Volunteer | Ek Pehal foundation June 2023

- Volunteered to teach underprivileged middle and high school kids as part of the Ek Pehal Foundation.
- Taught English, Maths and Physics for 6 hours per week

Menstrual Hygiene Drive | FARZ foundation November 2022

- Facilitated logistics and organised a menstrual hygiene campaign for schools in rural areas.
- Educated and lectured middle school students about the importance of menstrual hygiene in the modern day.
- Successfully helped organise the sanitary pad distribution drive for rural school students.

Additional Experience And Awards

- **Summer Fellow:** Completed a Summer Research Fellowship Program 2024 offered by the Indian Academy of Sciences at SVNIT Surat.
- Represented my Institute as a part of the Football Team at Parakram - ISM Dhanbad.
- Participated and won 1st place in the Interbatch Football Tournament 2025.
- Participated and won the Spring Pong - annual Table Tennis auction tournament
- Won gold medal in the International English Olympiad.
- Participated as a guitarist in RAMPAGE - the annual inter-college Band tournament.
- Won gold medal in annual inter-college Futsal tournament.

Technological Skills

Coding: C, Python, MATLAB, Qiskit, MySQL, Latex.

Softwares: Quantum ESPRESSO, Origin, GNU-Plot, NanoHub(MD software), WIEN2k, Wolfram Mathematica.

Others: Unsupervised Machine Learning, Fundamentals of DFT and MD.