SHOBHIT SAHEB DEY

E-203, Radhakrishnan Hall of Residence, IIT Kharagpur

Email ◇ Website ◇ LinkedIn

EDUCATION

Indian Institute of Technology Kharagpur *July 2018 - Present*
5th Year Student of Integrated MSc in Physics | INSPIRE Scholar *CGPA(as of June 2021) 8.39*

TECHNICAL STRENGTHS

Programming Languages	C, C++, Python, FORTRAN, MATLAB
Experimental Methods	Optics, Spectroscopy, Electronics, Cryogenics
Analysis and Numerics	FFTW, Dedalus, Eigen, MPI, Pandas, NumPy, SciPy
Computational Physics	Spectral Methods, Monte Carlo Methods, FEM, DMRG
Software & Tools	High Performance Computing(Certificate),Solidworks, LaTeX
Miscellaneous	AVR, Arduino, Control Systems, Image Processing, Computer Vision

RELEVANT COURSES

Fundamental courses	Quantum Mechanics, Electrodynamics, Classical Mechanics, Statistical Physics
Applied courses	Optics, CMP, Atomic and Molecular Physics, Nuclear and Particle Physics
Supplementary methods	Mathematical Methods, Electronics for Physicists, Experimental Methods
Electives and additionals	General Theory of Relativity, Semiconductor Physics, Advanced CMP Pattern Forming Instabilities, HPC for Complex Physical Systems Quantum Optics, Photonic Quantum Information Technologies

PROJECTS

Masters Thesis Project -Prof. Vishwanath Shukla | Prof. Sajal Dhara

Developed a robust spectral time-split code to simulate coherent and incoherent Bose condensation of exciton-polaritons to study nonequilibrium phenomena like BKT and KPZ physics. Corresponding experiments and required microcavity fabrication is also pipelined in Nano-optoelectronics lab.

PhLAM, CNRS | Charpak Lab Scholarship -Alberto Amo

Aimed to perform single-shot imaging of exciton-polariton superfluid flowing against a defect to study vortex shedding and turbulence. The experiment was built ground up from optical alignments to imaging in a 2 months internship under Charpak Scholarship **awarded to 30 students from India**.

Quantum Research Center -Prof. Luigi Amico

Proposed an experimental framework to engineer Negative Differential Thermal Conductance by photonic heat transport in superconducting circuits. Our Paper, submitted to **Physical Review B**, has been **appreciated by all the reviewers** and currently is in the final editing stage. [arXiv preprint]

Autonomous Ground Vehicles -Prof. Debashish Chakravarty

- Mentored the mechatronics team for **University Rovers Challenge** to be held at **Utah, USA** for building a semi-autonomous **Mars rover** capable of performing biochemical tests needed on the soil.
- For steering and speed control of a self-drive car, coded control systems like Stanley and iterative-LQR.
- Worked on Gaussian Process trained constrained iterative-LQG for motion planning and control tackling sensor noise and modelling error through on-the-go learning.
- Conducted several reading groups on introductory control systems and LQR to mentor the juniors.
- Mentored about 60 students in an IEEE-certified winter school on autonomous robotics, attended by 1^{st} and 2^{nd} year students. Taught various topics from Control Systems and Robot Operating System.

TERM PROJECTS

Linear theory of Faraday instability in viscous fluids using Floquet analysis Report
Fluid Mechanics | 4th Semester
The eventual instability of surface waves in a fluid being oscillated vertically, i.e Faraday Instability was analytically studied. Using Floquet analysis for time-evolution on spatial Fourier modes governed by linearized Navier-Stokes for surface disturbances, I numerically computed the instability boundaries.

Shadows of black holes and rendering image of accretion disk GitHub Report
General Theory of Relativity | 6th Semester
To study the shadow of a black hole i.e the null geodesics for different impact parameters are classified using Schwarzchild's metric. The Equations of Motion are further numerically integrated to render the images of an accretion disk around the black hole viewed at different angles.

Lie Groups: Geometry of dynamics and geometry preserving simulators Report
Mathematical Methods-II | 6th Semester
Dynamical systems are simulated using the Lie-Group integrators showing to preserve the symmetry of the system 10^{13} times better than Eulerian methods. An $SO(3)$ system is taken as a numerical example.

Analytical mechanics in optimal control theory Report
Classical Mechanics-II | 5th Semester
Pontryagin's principle is used to show how Hamilton's Equations can be used to develop optimal control policy for a system. LQR is derived using this principle and applied to steer a car for path tracking.

Monte Carlo simulations of Ising and XY-model GitHub Report
Computational Methods | 5th Semester
The 2D Ising Model and XY model were simulated using Metropolis Algorithm. Critical temperature and effects of the external field were found, while to speed up the codes, MPI parallel programming was used.

Relativistic Evolution of Synchrotron Radiation Report
Electrodynamics-II | 5th Semester
In this essay, I use relativistic arguments instead of Lienard-Wiechart equations to characterize the cyclotron-to-synchrotron radiation of an electron and deduce features like angular and spectral dispersion.

ACHIEVEMENTS

- Charpak Lab Scholarship for internship at PhLAM, CNRS, awarded to 30 students from India.
- Won the *Decoherence Competition* at IISc Bangalore in Pravega, 2020.
- Part of 2nd prize winning team at International Ground Vehicle Challenge 2019, Michigan(USA).
- Best Freshers at Cubiscan event in the techno-management fest, Kshitij 2019 held at IIT Kharagpur.
- Won the state-level CBSE Heritage India Quiz, 2015.
- Won the regional-level CBSE Science Exhibition, 2015.

POSITIONS OF RESPONSIBILITY

Awaaz(Chief Editor) **-Journalism and Technical Writing**
As a campus media body, we have written on a spectrum of topics spanning administrative issues, academic programs, industrial outlook, students' activities, research highlights, college politics and alumni talks.

Space Technology Students' Society

- Designed the problem statement on 'Gravitational waves and its similarity with electromagnetic waves' in National Students' Space Challenge 2019, India's largest of its kind.
- Gave Astro-presentations to the incoming UG batch of 2019 during their orientation program.
- Been a Junior Coordinator for National Students' Space Challenge 2018.