Saqlain Afroz

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Education

Indian Institute of Science Education and Research Kolkata *December 2020 – May 2025*
BS-MS Dual Degree in Physical Sciences (Ongoing)

- GPA: 7.99/10.0
- **Coursework:** Classical Mechanics, Quantum Mechanics, Statistical Mechanics, Astrophysics, General Theory of Relativity and Cosmology, Fluid and Magnetohydrodynamics, Condensed Matter Physics, Waves and Optics, Electromagnetism, Computational Physics, Quantum Field Theory, Non-Linear Dynamics, Thermal Physics, Mathematical Methods for Physicists, Real Analysis, Statistics and Probability, Topology, Linear Algebra

Inter-University Center for Astronomy and Astrophysics, Pune *August 2024 – April 2025*
Master's Thesis (Ongoing)

- **Supervisor:** Dr. Apratim Ganguly
- Deep Learning Based Search and Parameter Estimation of Gravitatioinally Lensed Gravitational Waves

Projects

Gravitational Waves Data Analysis *December 2021 - March 2022*

Guide: Dr. Rajesh Kumble Nayak

- I learnt how to access LIGO data, generate waveforms in the time domain and frequency domain, perform Q-transform, and the physics of coalescence of BBH or BNS.
- Tools Used: Python, GWpy, PyCBC, Astropy, GWOSC.

Numerical Relativity *August 2024 - Ongoing*

Guide: Prof. Rajesh Kumble Nayak

- I learnt 3 + 1 decomposition of Einstein's Field Equations.

Quantum Computation *December 2022 - August 2023*

Guide: Prof. Prasanta K. Panigrahi

- Quantum Simulation of Hawking Radiation Using VQE Algorithm on IBM Quantum Computer.
- Tools Used: Qiskit, Python, Colab

Klein's paradox in Graphene P-N Junction *January 2023 - April 2023*

Guide: Prof. Sourin Das

- This was my term paper project for my Advanced Quantum Mechanics course.

Developed Cubed-Sphere Grid to study Black-Hole Accretion Disks using Fortran (3 weeks short project) *August 2023 - September 2023*

Guide: Prof. Sudip Kumar Garain

- I developed a program to generate a cubed sphere which will be used to solve MHD equations of accretion disk.
- Tools Used: Fortran, Julia

Machine Learning Project *August 2022 - January 2023*

Guide: Prof. Kripabandhu Ghosh

- We had to develop a machine learning model which can do segmentation on clauses from Law contracts and then do clause classification.
- Tools used: Natural Language Processing

Skills

Programming Languages: Python, Julia, Matlab, Arduino, C++, C, Linux, LaTeX, JavaScript, NextJS

High Performace Computing: HTCondor, SLURM, PBS, OpenMP, MPI

Deep Learning & Machine Learning: PyTorch, CNNs, RNNs, LSTMs, SVMs, Physics Informed Neural Network, Decision Trees, K-means, k-NN, Random Forests

Statistical Techniques: Bayesian Inference, Maximum Likelihood Estimation, Hypothesis Testing, Markov Chain Monte Carlo (MCMC), Regression Analysis, Time Series Analysis

Software Tools & Frameworks: Git, Matlab, Colab, Bilby, Dingo, Qiskit, NumPy, SciPy etc

Spoken Languages: English, Hindi, Assamese, German, Russian

Experiences

GWOSC Workshop 5, 2022 *Cert.*

- A workshop organized by Gravitational Wave Open Science Center which taught concepts related to data analysis, noise characterisation, working of LIGO detectors, etc.

Quantum Information and Quantum Technology *Cert.*

- An International Conference, hosted by IISER Kolkata in 2023.

Qiskit Global Summer School 2022 *Cert.*

- A workshop organized by Qiskit for Introduction to Quantum Computation.

UP Science Talent Search Examination Scholarship *Cert.*

- A scholarship awarded by the State government for students highly talented in Basic Sciences.

NCC Special Trophy *Cert.*

- I was awarded a special trophy from National Cadet Corps, which is the youth wing of the Indian Armed Forces, for my excellent academic performance.

Robotics

- I built a semi-autonomous robot using Arduino that can detect obstacles in its path and safely tackle them while walking on a specified track, using infrared sensors and ultrasonic sensors.

Research Interests

Gravitational Wave Astrophysics

- Data analysis and noise characterisation of Gravitational waves.
- Theoretical aspects of gravitational waves physics, which is reflected in my project on Numerical Relativity.

Accretion and Black Hole Physics

- I am interested in modelling astrophysical phenomena in order to test alternate theories of gravity. I would like to explore X-ray observational techniques, Iron emission lines, Gravitational Waves etc.

Quantum Computation

- Simulating quantum systems.
- Development of quantum algorithms and quantum error correction techniques.

Machine Learning

- Making Deep Learning models for physical problems.
- I am also interested in exploring Quantum Machine Learning.

MOOCs

Machine Learning
By Andreww Ng
Coursera

Particle Physics: An Introduction
University of Geneva
Coursera

Introduction To Astrophysical Fluids
By Prof. Supratik Banerjee
IIT Kanpur, NPTEL

From Big Bang to Dark Energy
The University of Tokyo
Coursera

Extra-Curricular Activities

- **Painting:** I participated in a painting workshop and my art works were selected to be displayed in the exhibition.
- **Chess:** I have participated in chess tournaments in my Institute.
- **Athletics:** I participated in my district level athletics events and came at 2nd position in 100 m. I have also participated in Inter-IISER Sports Meet for athletics.
- **Web Development:** I have designed my own website using NextJS.
- **Management:** I have been Secretary of IISER Kolkata Student's Mess for two consecutive years as well as an Office Bearer of Institute's Gym. I was also Literary Captain of UP Sainik School.
- **Literature:** I got 1st and 2nd award for story writing competition from Lieutenant General at Sainik School in English and Hindi.
- Guitar, Photography, Cooking, Travelling, Speed-Cubing, Star-gazing