# Shivam Sawarn

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**ACADEMIC QUALIFICATION**

**Hindu College**, University of Delhi
*Master of Science*, Physics, June 2023                           GPA: 6.4

**Jamia Millia Islamia**
*Bachelor of Science*, Physics, June 2021                         GPA: 9.28

**IELTS: 7.0**(7(L),8(R),6(W),7(S))

**PUBLICATIONS**

*In preparation*: Ram Soorat, Akhilesh Dubey, **Shivam Sawarn**, Priyanka, Shaik Ahmed, *Investigating the Effects of Laser Linewidth and Detector Bandwidth on Signal Behavior with Homodyne Technique*, **Modern Physics Letters-B (I.F: 1.948)**, 2023

**CONFERENCE PRESENTATION**

Ram Soorat, Akhilesh Dubey, **Shivam Sawarn**, Priyanka, Shaik Ahmed, *Investigating the Effects of Laser Linewidth and Detector Bandwidth on Signal Behavior with Homodyne Technique*, **International Conference on Mathematical Modelling and Emerging trends in Computing**, Hyderabad, June 2023

**Shivam Sawarn**, Akhilesh Dubey, *Target Probabilities with Quantum Circuits*, **South Asia Wolfram Virtual Technology Conference**, Remote, Feb 2023

**RESEARCH EXPERIENCE**

**Research Intern**, *Physical Research Laboratory, Department of Space, India*
Guide: *Prof. R.P. Singh*, Head, AMOPH Division            May 2023 - Dec 2023

- Working on 'Simulation of Quantum Networks' and experimental techniques in a team setting.
- Familiarized myself with a variety of quantum network simulators such as QKD-NetSim, QuISP, NetSquid, QuNetSim, SQUANCH, SeQUeNCe and SimulaQron and chose SeQUeNCe for its flexibility and scalability.
- Analyzed the BB84 protocol within the SeQUeNCe simulator, conducting an in-depth study on throughput, error rates and latency.
- Working on three node quantum network simulation and hands-on experimental techniques in Quantum Optics Lab.

**Quantum Open systems and Master Equation Implementation through Reinforcement Learning**, *IBM QAMP Fall'22 & Spring'23*            Sep 2022 - Present
Guide:*Abhijit Mitra, Dr. Vaibhaw Kumar*(IBM)

- Worked out on proofreading of Unitary and non-Unitary part of Open Quantum Systems Dynamics and on different noise models including Markovian and non-Markovian noises.
- Responsible for applying different protection and recovery reward of the agent required for reinforcement learning of the non-unitary part of Schrodinger equation.
- Applied simple instances of open system on models like Quantum Boltzmann Machine(QBM) which showed perfect match between the probability generated and expected.
- Working on solving complex quantum open system through QITE models.

**Quantum Global Summer School**, *IBM*                              July 2022

- Attended 4 weeks summer school focused on Quantum simulations.

- Developed the skills and know-how to explore the world of quantum computing and its applications with a focus on quantum simulations using NISQ hardware.
- Gained significant knowledge and skill in quantum computation, using the physics, math, and python skills required to model a molecule using Qiskit.

**Predicting the Electron Invariant Mass from the CERN Dielectron Collision Data**, *Wolfram India School*      Jan 2022
- Attended 3 weeks school and completed the project under a mentor.
- Explored various features of the di-electron collision using rigorous data analysis tools on a dataset consisting 100,000 dielectron events in the mass range 2-110 GeV.
- Used a custom neural network on test dataset for predicting the invariant mass of the electron.

**Energy and Probability density of Hydrogen atom (Among the top 3 projects in the batch of 2021)**
*As part of B.Sc Computational Physics project*      May 2021
- Simulated the Radial probability density and Energy associated with different states of Hydrogen in FORTRAN.
- Applied Numerov-Cooley method to visualize and shown comparison of different states .

**INDUSTRIAL EXPERIENCE**

**Consultant**, *Wolfram Research, Inc.*      Feb 2022 - Present
- Work with Quantum Framework team which is responsible for creating framework that offers general suite of modelling capabilities for simulating quantum computation, with full integration into Mathematica and Wolfram Language.
- Create community post regularly on various topics of Quantum Information Theory such as Quantum counterpart of Classical gates, Distance measures for Quantum Information, Interactive Bloch sphere, Quantum State
- Responsible for algorithm development, proofreading and checking existing algorithm of the Framework.

**Qiskit Advocate**, *Qiskit*      Aug 2022 - Present
- Recognized for my contributions to the Qiskit and the quantum community, and demonstrating an ability and commitment to educate and influence others by sharing ideas, knowledge and expertise in the field of quantum computing.
- Gathered a deep level of understanding with Qiskit including circuits, algorithms, simulators, qubits and noise.
- Responsible for mentoring various IBM Quantum Community Events like Quantum Challange, Quantum Explorer, Global Summer School

**TEACHING EXPERIENCE**

**Mentor:**,
- **IBM Qiskit**
  - Quantum Global Summer School 2023
  - IBM Quantum Challange Spring'23
  - IBM Quantum Challange Fall'22
- **Wolfram Summer School 2023**
  - Responsible to guide four students from Physics track and assisting them in creating an original project.
- **Wolfram Fundamental Science Winter School 2023**

– Responsible to guide two students from Science track in creating original project.

– Projects proposed were 'Target Probabilities with Quantum Circuits' and 'n-p type problems'.

**Teaching Assistant:**
- **Wolfram Summer School 2022**

    – Aided 20+ students in coding for projects proposed during the school.

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| **HONOURS/ AWARDS** | • Graduated from Bachelors (Hons.) Physics Program(*2018 batch*), **Rank 1** in Jamia Millia Islamia. |

- Graduated from Bachelors (Hons.)  Physics Program(*2018 batch*), **Rank 1** in Jamia Millia Islamia.
- Ranked under **top 12%** in Joint Admission test for Masters (IIT-JAM) out of total 14298 candidates.
- Cleared several IBM Quantum Challanges:

    – Spring 2023

    – Spring 2022

    – Fall 2021

    – Africa 2021

**CERTIFICATION** **IBM Certified Associate Developer - Quantum Computation using Qiskit v0.2x**
- IBM Professional Certification for the experience using the Qiskit SDK to create and execute quantum computing programs on IBM Quantum computers and simulators.

**QWorld Diplomas**
- Received for completing the online workshop Quantum Computing & Programming during the QWorld Summer School 2021, focusing on complex numbers and Shor's algorithm.

**Python**
- Received various certifications like NPTEL, IIT Kanpur for demonstration of proficiency in the language.

**SageMath**
- Received certification from NPTEL for demonstration of proficiency in the language.

**RELEVANT COURSEWORK** **Linear Algebra**: linear vector spaces, Inner product, norm, Schwarz inequality, linear operators, Hermitian or self-adjoint operators, unitary operators, ortho-normal basis–discrete and continuous.

**Group Theory**: Abstract groups, classes, cosets, factor groups, normal subgroups, Homomorphism, isomorphism, Schur's lemma and orthogonality theorems, Lie groups, rotation and unitary groups, Representation of SO(3), SU(2), SU(3) and SO(3,1), Tensors.

**Quantum Mechanics**: Quantum Dynamics, Angular Momentum, Approximation Methods for Stationary Systems, Approximation Methods for time-dependent perturbations, Scattering, Relativistic Quantum Mechanics

**Optics**: Interference, Diffraction, Lasers, Polarization, Holography, Optical Spectroscopy, Electro-optic modulation, Magneto-optic modulation, Acousto-optic modulation, Sound modulation of carrier waves.

**ElectroMagnetic Theory**: Maxwell's Equations, Relativistic Charged Particle Dynamics in Electromagnetic Fields, Radiation, Lagrangian Formulation of Electrodynamics

**Mathematical Physics**: Special Functions, Tensors, Complex Analysis, Linear Vector Space, Theory of Probability and Statistics, Complex Analysis, Group Theory

**Computational Physics**: Scientific Programming and Logic, Visualization using FORTRAN, Introduction to C as well as application for Numerical Analysis.

**Labs**: Lab 1(*Mechanics & Oscillation*), Lab 2(*Electronics (Analog) & Thermal Physics*), Lab 3(*Optics*), Lab 4(*Electricity & Magnetism*),Lab 5(*Modern Physics*), Lab 6(*Advanced Electronics*), Lab 7(*Nuclear Lab*), Lab 8(*Solid State*)

**COMPUTER SKILLS**

**Languages**: Python, C, Wolfram, LaTeX, FORTRAN

**Packages**: QuTiP, SageMath, Scipy, Numpy, Matplotlib

**Software**: Mathematica, Visual Studio, Git, VirtualBox

**Operating Systems**: Unix, Linux, Mac OSX, Windows