Gaurav Agarwal

Integrated M.Sc. Physics,
UM-DAE-CBS, Mumbai, India

gauravag99.github.io
gaurav.agarwal@cbs.ac.in
+91-6395660756

Education

- **Integrated Physics M.Sc.** 2018-2023
  Centre for Excellence in Basic Sciences (UM-DAE-CEBS) *Mumbai, India*
  CGPA : 8.78/10
- **High School - CBSE** 2015-2017
  Little Scholars *Kashipur, India*
  Scored 99.718%ile nationwide (1.1 million appeared.)

Research Interests

Quantum Computing, Superconducting qubits, Quantum Information, Mesoscopic Physics, Physics aware machine learning.

Projects

- **Superconducting Qubits - Master's Thesis** Aug, 2022 - Present
  with Prof R. Vijayaraghavan, TIFR *Mumbai, India*
  - Set up control protocols for a 7 qubit system using QM's FPGA platform for DRDO, Govt of India.
  - Microwave component optimization : Implementation of side band modulation using Super-Heterodyne for control of multi-qubit systems.
  - Drift : Automating corrections for drift in microwave components, qubits and amplifiers.
  - 2 Qubit RB : Group table, sequence generation, and testing on the system above.
  - LabView to Python : Developed all modules for low-level instrument control using Python.

- **Superconducting Tunnel Junctions (STJs)** Jan, 2022 - Apr, 2022
  with Prof. Sangita Bose, CEBS and Prof. Pratap Raychaudhari, TIFR *Mumbai, India*
  - Learnt standard techniques associated with dry and wet cryogenic systems.
  - Simulated and measured band-gaps of NbN-oxide-Ag STJs.
  - Used Maki analysis to simulate, analyze & characterize STJs under magnetic fields.

- **Graphene - electronic properties and defects** Sep, 2021 - Dec, 2021
  with Prof. Vijay Singh, HBCSE/UM-DAE-CEBS *Mumbai, India*
  - Modeled Graphene using the tight-binding model with next-nearest neighbor interaction.
  - Studied the properties of Dirac electrons on the lattice.
  - Implemented the Koster-Slater model to study substitutional defects on the band structure.

- **Brownian Motion (BM) and Fractional BM (fBM)** Jun, 2021 - Aug, 2021
  with Prof. Tridib Sadhu, TIFR *Mumbai, India*
  - Studied statistical properties of BM and fBM.
  - Studied time evolution with Langevin & Fokker-Planck equations.
  - Simulated BM and verified variance, Khinchin's laws and arcsine laws.
  - Generated fBM samples with Hosking and Cholesky methods.

- **Exploration of experimental physics in the UG lab** Jun, 2019 - Jul, 2019
  with Prof. R. Nagarajan, UM-DAE-CEBS *Mumbai, India*
  Development of a data acquisition system
  - DIY-ed a data acquisition system using Arduino & Raspberry Pi for the UG lab.
  - Learnt technicalities of electronics for fast data collection, live processing and storage.
  - Demonstrated/taught experiment(s) to summer-school participants using the system.

  Other experiments on:
  - Microwave diffraction, interference and standing waves.
  - Frequency response of Piezo-electric disks and films.
  - Working and use of in-house DIY made Lock-in Amplifiers.

Other Achievements

DISHA Scholarship by Dept. of Atomic Energy, Govt. of India 2018-23
All India Rank 76 in National Entrance Screening Test 2018
Attended **Vijyoshi National Science Camp** by Indian Institute of Sciences, Bangalore . . 2018

Skills

- **Languages** : Speaking, reading and writing proficiency in English and Hindi.
- **Programming** : Python (QUA, QuTiP, QuCAT, Qiskit, QCoDeS PyVISA, SciPy, Matplotlib, Numpy, Numba, multiprocessing, Cython), Fortran 95, LaTeX, Tensorflow, PyTorch, Bash.
- **Software** : GNU/Linux, AWR, COMSOL, LabVIEW, Mathematica, gnuplot, Origin, Google Colab, git, GIMP, Resolve.
- **Hardware** : Standard RF setup for cryogenic measurements, dilution refrigerators, He cryostats, Sputtering, Arduino, Raspberry Pi, QM's FPGA OPX.

Certifications

- **Machine Learning for Chemistry and Drug Design** 2022
  Certificate : Github Link *IIITH*
- **Neural Networks and Deep Learning by Andrew Ng** 2020
  Certificate : http://coursera.org/verify/VW66ZFSGKEAK *deeplearning.ai*
- **Improving DNN: Hyperparameters and Regularization by Andrew Ng** 2020
  Certificate : http://coursera.org/verify/WH6J33HKTSAG *deeplearning.ai*
- **Structuring Machine Learning by Andrew Ng** 2020
  Certificate : http://coursera.org/verify/4SEWMPSLFV96 *deeplearning.ai*
- **Convolutional Nets and Deep Learning by Andrew Ng** 2020
  Certificate : http://coursera.org/verify/456AC27RF993 *deeplearning.ai*
- **Machine Learning by Andrew Ng** 2020
  No certificate *Stanford, Coursera*

Experience/Positions of Responsibility

- **Teaching**: Designed, setup and demonstrated experiments in the UG Physics lab to summer school participants.
- **Organizer - Inter-college Sports Event**: Managed administrative paperwork, volunteers, marketing, and organized 50+ Badminton matches within restrictive player schedules.
- **Organizer - Movie Club**: Responsible for selection, marketing and screening movies & documentaries across different genre and languages every Friday night at the institute.
- Designed and delivered a flyover(bridge) proposal to the Mayor of Kashipur (**approved, construction started, 2016**)

Relevant Courses Undertaken

Microwave Engineering, Quantum Field Theory, Quantum Optics, Non-linear Dynamics, Many Body Theory

References:

- **Prof. R. Vijayaraghavan**
  Tata Institute of Fundamental Research, Mumbai *Master's thesis guide*
- **Prof. Sangita Bose**
  UM-DAE-CBS, Mumbai *Project guide, 2 theory courses & a lab course*
- **Prof. Dipan Ghosh**
  IIT Bombay & UM-DAE-CBS, Mumbai *4 theory courses*
- **Prof. R. Nagarajan**
  UM-DAE-CBS, Mumbai *Project Guide & taught courses*