HARSHVARDHAN K. BABLA

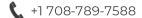+1 708-789-7588 | hbabla@princeton.edu / harshbabla@gmail.com | harshbabla99.github.io | linkedin.com/in/harshbabla

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RESEARCH INTERESTS

Quantum Computing, Quantum Simulation, Quantum Optics, Experimental Condensed Matter Physics, Coherent Ising Machines, Hybrid Quantum Systems.

EDUCATION

Princeton University   *Aug. 2017 – May. 2021*

B.S.E. in Electrical Engineering (focus in Quantum Information).
GPA: 3.53/4.00
Certificates: Engineering Physics, Applied and Computational Mathematics, Applications of Computing.
Honors: Princeton Electrical Engineering Slingshot Fund Winner – Summer 2019

RESEARCH EXPERIENCE

Lyon Lab, Princeton University   *Sept '20 - Present*

Advisor: Prof. Stephen Lyon

- Senior thesis project to fabricate large arrays of identical metal-oxide quantum dots for ensemble quantum computing using electrons on liquid-Helium.
- Designed prototypes for the quantum-dot devices using nanofabrication tools, such as thin-film metal deposition, reactive ion etching, and confocal microscopy.

Institut Quantique, Université de Sherbrooke   *May '20 - Aug '20*

Advisor: Prof. Alexandre Blais

- Studied the relationship between the decoherence time, T_1 of Transmon qubits and the mean photon number, $\bar{n}$ in the associated readout resonator.
- Designed pulse sequences and performed experiments on qubits available through the IBM Quantum Experience (IBM Qiskit Pulse) as well through collaboration with experimental groups.
- Analyzed these trends using theoretical models such as dressed dephasing and drive induced lifetime renormalization.

Houck Lab, Princeton University   *Jun '19 - Feb '20*

Advisor: Prof. Andrew Houck
Publication: arxiv.org/abs/2003.00024

- Developed a set of microfabrication techniques for the first ever set of Tantalum-based Transmon quantum-bits, to consistently achieve increased T_1 coherence times - with an average exceeding 0.30ms, almost three-times the longest T_1 previously published (0.114ms).
- Characterized these procedures through imaging techniques such as Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM), and X-ray Photoelectron Spectroscopy (XPS).
- Developed a recipe to eliminate carbon impurities and improve surface adhesion by cleaning sapphire substrates.
- Refined my science communication skills through writing a 30-page junior paper and editing the journal submission.

Houck Lab, Princeton University   *Jun '18 - Aug '18*

Advisor: Prof. Andrew Houck

- Developed a Python GUI to design circuits of superconducting resonators for the purpose of simulating photonic lattices. The GUI can generate CAD designs of the circuits, for rapid translation from theory to photolithography.
- Wrote Python code to diagonalize Jaynes-Cummings Hubbard Hamiltonians used to model these photonic lattices.
- Codebase is still actively used by members of the lab for quantum simulation research.

ACADEMIC PROJECTS

High Bandwidth Transimpedance Amplifiers for High-Speed Fiber Optic Communication   *Fall '20*

Final Project for Wireless and High-Speed Integrated Circuits and Systems (Graduate Level)

Tensor Factorization and Regularized Optimization to Detect Latent Features in fMRI data   *Fall '20*

Final Project for Mathematics of High Dimensional Data (Graduate Level)

Low-Cost Mechanical Ventilator for the COVID-19 Pandemic   *Spring '20*

Final Project for Robotics and Autonomous Systems

Information Aggregation via Asynchronous Learning in Time-Evolving Social Network Graphs   *Fall '19*

Final Project for Advanced Algorithm Design (Graduate Level)

Error Mitigation for Near-Term Quantum Computing   *Feb '19*

IBM Qiskit Camp and Hackathon

Autonomous Obstacle-Avoiding Drone   *Sept '18 – Jun '19*

Princeton Robotics Club, Team Lead

KEY COURSES

Physics: Quantum Mechanics I & II, Quantum Information and Computation, Quantum Optics, Condensed Matter Physics (Graduate Level), Advanced Electromagnetism.

EE and CS: Electronic and Photonic Devices, Machine Learning and Pattern Recognition, Advanced Algorithm Design (Graduate Level), Mathematics of High Dimensional Data (Graduate Level), Wireless and High-Speed ICs (Graduate Level), Classical and Modern Optics, Contemporary Logic Design, Signal processing, Low-level system programming.

Math: Abstract Algebra (Group and Representation Theory), Cryptography, Probability and Stochastic Systems.

LEADERSHIP ACTIVITIES

Signals and Systems (ELE201)   *Fall '20*

    Peer Tutor: Explained concepts related to Fourier and Laplace transforms through one-on-one tutoring sessions.

Contemporary Logic Design (ELE206)   *Fall '18, Fall '19*

    Undergraduate Teaching Assistant: Answered questions related to digital logic and RTL design and assisted students debug their coding projects in Verilog.

Policy Punchline Podcast   *Apr 20 - Present*

    Co-Host and Science Correspondent: Interview leading researchers in science and path-breaking entrepreneurs on the societal impacts of new technologies.

IgniteSTEM   *Sep '18 – Apr '20*

    Team Lead for Sponsorships: Led a team that has raised upwards of USD. 50,000 for our bi-annual conferences that are aimed at promoting project-based-learning and creative learning methods to high-school teachers. Partnered with leading EdTech companies for product giveaways and awards to inspirational teachers and educators.

IEEE - Princeton Chapter   *Oct '19 - Present*

    Co-President: Revived the IEEE chapter at Princeton. Organize graduate school and job application workshops, mentor-mentee groups, research talks for Electrical Engineering majors at Princeton.

Princeton Robotics Club   *Sep '18 – May '19*

    Team Lead for Autonomous Drone Hardware Team: Led a team that focused on optimizing the control systems for the drone's autonomous flight and coding perception algorithms to interpret data from an array of sensors, including time-of-flight sensors, cameras, and motor-encoders.

SKILLS AND HOBBIES

Other Languages

Fluent in Hindi, Swahili, and Gujarati. Conversational proficiency in French.

Hobbies

Singing (Base and Lower Tenor), Swimming, Pencil sketching.