Kartikeya Arora

Ph.D. Student
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EDUCATION

University of Southern California
Ph.D., Electrical Engineering
Aug '24 – May '29 (expected)

Indian Institute of Technology (IIT-BHU)
IDD (B.Tech + M.Tech) Honors, Engineering Physics
GPA: 9.33/10
Jul '19 – May '24

RESEARCH INTERESTS

Quantum Optics, Quantum Error Correction, Quantum Simulations, Quantum Information, Circuit QED, Non-Equilibrium Quantum Dynamics, Tensor Networks, Computational Many-Body Physics

PUBLICATIONS

Arora, K., Singh, R., and Hosur, P. *Suppression of one-dimensional weak localization by band asymmetry*, Phys. Rev. B 108, 064211 (2023)

Roy, S., et al., *Synthetic High Angular Momentum Spin Dynamics in a Microwave Oscillator*, Phys. Rev. X 15.021009 (2025)

RESEARCH PROJECTS

Synthetic Big Spins in microwave cavities: a bosonic code with built-in gates
Supervisors: Dr. Baptiste Royer (Universite de Sherbrooke), Dr. Valla Fatemi (Cornell University)
Duration: Mar '23 – Feb '24

- Simulated mapping between oscillator and big spins to adjust matrix-elements of gate operations by modeling the qubit + resonator device driven by a frequency comb
- Executed numerical simulations to perform Floquet Analysis, optimization calculations to propose optimum parameters and techniques to enhance operational gate fidelities
- Worked with experimental group at Cornell University to reproduce spectroscopy plots using open system simulations
- Manuscript *Synthetic high angular momentum spin dynamics in a microwave oscillator* published in **Physical Review X**

Design, Fabrication, Measurement, and Characterization of Tunable Xmon Qubit
Supervisor: Canada Microelectronics Corporations (CMC) Microsystems
Duration: Jun '23 – Jan '24

- Attended the workshop *Build Your Own Superconducting Quantum Device 2023*
- Learned about the theory of superconducting quantum devices, designing process of superconducting quantum circuits, fabrication, measurement and characterization techniques
- Used ANSYS (HFSS, Q3D) and CMC measurement analysis software by CMC

- Designed and simulated **tunable Xmon qubit** using SCqubits and ANSYS
- Participated in fabrication, measurement, and characterization of the qubit

Hamiltonian Mechanics and Electron Hopping Observations in Lattices of Asymmetric Energy Functions
Supervisors: Dr. Pavan Hosur (University of Houston), Dr. Rajeev Singh (IIT-BHU)
Duration: Nov '21 – May '23

- Employed Exact Diagonalization and Recursive Green's Function Method to study the quench dynamics of Participation Ratio and localization length for disordered tight-binding Hamiltonians with asymmetric Next-Nearest Neighbor hopping
- Computed weak localization correction to conductivity by employing Renormalization Group and Perturbation Theory calculations using Feynman Diagrams to conclude that conductivity increases with the increase in asymmetry of left and right movers' Fermi velocities
- Manuscript *Suppression of one-dimensional weak localization by band asymmetry* published in **Physical Review B**

Non-Equilibrium Properties of Quantum Spin Chains
Supervisor: Dr. Rajeev Singh (IIT-BHU)
Duration: Aug '20 – Oct '22

- Learned and applied Exact Diagonalization and **DMRG** to study Real-time confinement following a quantum quench to a non-integrable model (Project Report)
- Performed calculations of Spectral Form Factor in interacting spin chains on **IBMQ**

Quantum Phase Transitions in tJ Model
Supervisor: Dr. Ujjwal Sen (HRI, Allahabad)
Duration: Jun '21 – Aug '21

- Studied Quantum Phase Transitions and Correlation Functions in Rabi Model
- Applied **Kibble-Zurek Mechanism** to Quantum Spin Chains
- Analyzed Adiabatic Theorem for tJ model

TECHNICAL SKILLS

Languages: C/C++, R, Python, Julia, LaTeX, MATLAB, Mathematica
Quantum Computing Languages: Qiskit, Cirq
Simulation Software: Qiskit Metal, ANSYS (HFSS, Q3D, Maxwell), Ledit, AWS Palace

ACADEMIC ACHIEVEMENTS & MOOC'S

- Workshop: *Quantum Device Design Workshop - Superconducting Qubits 2025* (UCLA)
- Workshop: *Build Your Own Superconducting Quantum Device 2023* (CMC Microsystems)
- IBM Summer Schools: *Introduction to Quantum Computing, Quantum Simulations*
- QWorld: QBronze, QSilver Diplomas

POSITIONS OF RESPONSIBILITY

- **Teaching Assistant**: PHY-101 - Classical, Quantum and Relativistic Physics at IIT-BHU
- **Volunteer**: Research Community of IIT-BHU
- **Teaching Assistant**: Harvard GSAS Mini-Course (*What is Computation? From Turing Machines to Black Holes and Neurons*)
- **Volunteer**: Kashi Utkarsh (STEM education initiative)