# Parth Jatakia

Princeton University
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## RESEARCH INTEREST

Hybrid quantum systems, Quantum information processing, Experimental condensed matter physics, Quantum Optics, Translation to quantum technology.

## CONFERENCE PROCEEDINGS & PUBLICATIONS

1. Characterizing Initial Correlation via Spectroscopy, QFF - RRI, Bangalore *January 2020*
2. Characterizing Initial Correlation via Spectroscopy, APS March Meeting, Boston *March 2019*
3. Parth Jatakia, Sai Vinjanampathy, Kasturi Saha. **Detecting Initial Correlations via Correlated Spectroscopy in Hybrid Quantum Systems.** arXiv:1912.06632 *(Accepted by Scientific Reports)*

## EDUCATION

**Princeton University** *2020 - 2025*
Ph.D. Candidate, GPA - 3.9/4.0,
Advisor : Prof. Andrew Houck, Houck Lab

**Indian Institute of Technology Bombay** *2015 - 2020*
**BTech. & M.Tech**. (Dual Degree) in **Engineering Physics** with specialization in **Nanoscience**,
Minor in **Computer Science**, GPA - 9.15/10

## RESEARCH EXPERIENCE

**Heavy Fluxonium qubit at zero flux bias** *March 2021 - Present*
*Prof. Andrew Houck, Princeton University*
- Engineering heaviness of Fluxonium qubits to optimize the trade-off between $T_2$ and $T_1$.
- Designing Fluxonium qubits with structure property resolved through HFSS simulation such that predicted device parameters are close to SCQubit simulations.
- Fabricating the designs and packaging the qubit. Measuring coherence properties of the qubits at zero and half flux.

**Double quantum dot in silicon as a two-qubit spin quantum computing architecture** *Sept 2018 - May 2020*
*Prof. Suddhasatta Mahapatra, IIT Bombay*
- Nanofabrication of nano-scale devices in semiconductor heterostructure (Si - SiGe).
- Optimised all recipes for processes such as lithography of nanoscale gates, ion implantation, metal deposition, etc required for realizing the quantum architecture.
- Fabricated heterostructure based devices to observe quantum hall effect and coulomb blockade.

**Spin Squeezing in Nitrogen Vacancy Centre (NV)** *January 2019 - May 2020*
*Prof. Kasturi Saha, IIT Bombay & Prof. Saikat Guha, University of Arizona*
- Worked on Hamiltonain engineering for NV ensemble interacting with optical cavity mode to generate spin squeezing.
- Modelled open quantum system dynamics of the NVs interacting with the cavity modes (upto 100 NVs).
- Optimising control sequence to generate maximum spin squeeze to create metrologically superior states.

**Detecting Initial Correlations via Correlated Spectroscopy in Quantum Systems** *July 2018 - May 2020*
*Prof. Kasturi Saha, IIT Bombay & Prof. Sai Vinjanampathy, IIT Bombay*
- Developed a general method for detecting and characterizing initial correlation present between the system & environment.
- Applied on NV centers placed within a cavity to extract information like pairwise coupling, decay rates, hidden within the initial correlations.

## ACADEMIC PROJECTS

**Measurement-Induced State Transitions in a Superconducting Qubit** Quantum Optics, Princeton: *Spring 2021*
- Recreated results from Sank et al 2016 using Qiskit and IBM Armonk to investigate the possibility of driving the qubit to higher energy states by populating the cavity with a large number of photons.

**Exotic Topological Order in Fractal Spin Liquids** Adv Quantum Mech, Princeton: *Spring 2021*
- Recreate and understand the calculations presented in Yoshida 2013 paper on exotic topological ordering of $2D$ and $3D$ spin liquids

**Electrical & Optical nature of reduced graphene oxide,** Adv Techniques in Nano, IIT Bombay: *Spring 2019*
- Measured transmittance and resistivity of multiple hydrazine reduced graphene oxide films with variations in reduction.

**Hardware Emulation of Quantum Algorithms,** Electronics Lab III, IIT Bombay : *Spring 2017*
- Simulated two qubit Fourier transform on Field Programmable Gate Arrays (FPGAs) using parallelism feature.

**Microwave Plasma CVD of Diamond,** Prof. Kantimay Das Gupta, IIT Bombay : *Winter 2016*
- Improved and deposited diamond using MPCVD system, and further characterized them using Raman spectroscopy.

**Turing Pattern in Reaction Diffusion System** Non-Linear Dynamics, IIT Bombay: *Autumn 2016*
- Studied non-linear dynamical equations for a reaction diffusion system through linear stability analysis and bifurcation.
- Simulated reactions in 2D for various initial & boundary conditions to obtain striped and spotted Turing patterns

**Imaging Algorithms in PET Scan** Prof. Pragya Das, IIT Bombay *Summer 2016*
- Investigated probabilistic models of detection for PET and implemented expectation-maximisation for image generation.

**Computer Player for Othello** Computer Programming and Optimisation, IIT Bombay *Autumn 2015*
- Used the MiniMax algorithm augmented with $\alpha - \beta$ pruning to calculate winning move efficiently.

## ACADEMIC ACHIEVEMENTS

- Awarded Ilian Mihov *96 Graduate Fellowship *2020-21*
- Ranked **1028**$^{th}$ nationwide among 1.5 lakh students in Joint Entrance Examination for IITs. *2015*
- Ranked **1740**$^{th}$ nationwide among 13 lakh students in Joint Entrance Exam for all engineering colleges in India. *2015*

## KEY COURSES

**Physics :** Quantum Optics, Advance Quantum Mechanics, Quantum Spectroscopy, Implementations of Quantum Information, Physics of Quantum Devices, Physics of Nanostructure & Nanoscale devices, Advanced Lab techniques in Nanoscience, Analytical Techniques, Semiconductor Physics, Introduction to Atomic & Molecular Physics, Quantum Information & Computation, Quantum Mechanics I & II, Photonics, Non Linear Dynamics.
**Electrical :** Digital Systems, Transistor Lab, Op-Amp Lab, Microprocessor Lab, Digital Electronics Lab
**CS :** Machine Learning, Design and Analysis of Algorithm, Data Structures & Algorithms, Operating Systems
**Math :** Group Theory, Calculus, Linear Algebra, Differential Equations I & II, Complex Analysis, Numerical Analysis

## SKILLS & EXPERIENCE

**Programming & Softwares :** Python, QuTip, Solidworks, MATLAB, Mathematica, , C/C++, QISKIT, HTML, VHDL, AutoCAD, TensorFlow, NumPy, SciPy, ScQubits, HFSS, COMSOL Multiphysics
**Fabrication Tools :** Electron Beam Lithography, Photolithography, Scanning Electron Microscopy, Atomic Force Microscopy, Sputtering, Thermal Evaporator, Reactive Ion Etchning, Plasma Ion Immersed Implantation, Atomic Layer Deposition, Plasma Asher

## POSITION OF RESPONSIBILITY

**Assistance in Instruction,** ECE 511 Quantum Mechanics, Princeton: *Fall 2021*
- Teaching and grading graduate level quantum mechanics course to a batch of 15 graduate students.

**Department Academic Mentor,** IIT Bombay: *2019-2020*
- Mentoring weak performing senior students to help them navigate their undergraduate life.

**Teaching Assistant,** Electronics Transistor lab, IIT Bombay: *Autumn 2019*
- Mentored a batch of 15 students through lab and help sessions, and graded their assignments and paper.

**Convener,** Maths & Physics Club, IIT Bombay: *2016-17*
- As part of a team of eight students, organized group discussions, lab visits, competitions and talks

## PUBLIC TALK

- **Quantum Computing Workshop :** Introduced various quantum systems and respective architectures to realize a qubit and further a quantum computer. *2019, 2020*

## EXTRACURRICULAR

- **Quantum Reading Group :** Organised 6 seminars by professors, students and alumni in Quantum Technology.
- **Academic Volunteer Program :** Conducted help session in Quantum Mechanics II & Condensed Matter Physics.
- **Mentor for Summer Reading :** Mentored students interested in quantum computing during summer for 3 years.
- **National Service Scheme :** Teaching science and mathematics to underpriviledged students.