Parth Jatakia

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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

EDUCATION

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

Double quantum dot in silicon as a two-qubit spin quantum computing architecture *Sept 2018 - Present*
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.
- Fabricating heterostructure based devices to observe quantum hall effect and coulomb blockade.

Single Nitrogen Vacancy Centre (NV) Detection, Measurement and Control Setup *July 2019 - Present*
Prof. Kasturi Saha, IIT Bombay
- Assembling optical setup along with confocal microscopy for single NV experiments.
- Calibrating and synchronizing various components like piezo stage, single photon detector, microwave generator.

Spin Squeezing in Nitrogen Vacancy Centre (NV) *January 2019 - Present*
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 Hybrid Quantum Systems *July 2018 - Present*
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.

CNOT gate using Nitrogen Vacancy (NV) Centre and ^{15}N nuclear spin *May 2018 - July 2018*
Prof. Dieter Suter, TU Dortmund
- Numerically optimized phases of the pulse sequence to effectively generate CNOT gate between NV spin and adjacent nitrogen-15 nuclear spin
- Characterized the delay between I/O of the Direct Digital Synthesizer (DDS) to obtain time-delay in the pulse sequence.
- Improved contrast of SNR of the wide-field image of NVs in the diamond by rebuilding part of the optical setup.

ACADEMIC ACHIEVEMENTS

- 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*
- Awarded **INSPIRE** scholarship by Maharashtra government for placing in top 1% of students appearing for matriculation exam. *2015*
- Awarded Scholarship By Maharashtra State Council of Examination. *2007*

ACADEMIC PROJECTS

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.

Voltage gain property of PMTs in magnetic fields, Prof. Tsutomu Mibe, KEK, Japan : *May 2017*
- Observed abnormality in voltage gain of Photo-Multiplier Tubes (PMTs) using indigenously built 20 Gauss solenoid and nanosecond photon pulse generator.

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.

Digital Music Synthesis, Waves & Oscillation, IIT Bombay : *Spring 2017*
- Digitally replicated guitar, flute, violin and piano, & reproduced the reverberation effect of sound in a large hall.

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.

KEY COURSES

Physics : 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
Fabrication Tools : Electron Beam Lithography, Scanning Electron Microscopy, Atomic Force Microscopy, Sputtering, Thermal Evaporator, Reactive Ion Etchning, Plasma Ion Immersed Implantation, Atomic Layer Deposition, Plasma Asher.

POSITION OF RESPONSIBILITY

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

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

Convener, Maths & Physics Club; *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. *April 2019*

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.
- **1st Position in Physics Bazinga :** Won the Intra IIT Bombay physics quizzing competition.
- **2nd Position in PhysX GC :** Won the Intra IIT Bombay physics experimental competition.
- **2nd Position in TechnoVoltz :** Won a National Level competitive coding competition by Techfest in 2015.
- **Freshman of the Year Award :** For outstanding contribution in technology to Hostel 2
- **National Service Scheme :** Teaching science and mathematics to underpriviledged students.