Pratyush Anand

Curriculum Vitae

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"I, a universe of atoms, an atom in the universe."
-Prof. Richard Feynman

Education

Sep 2024 **EECS Ph.D. Researcher**, *Massachusetts Institute of Technology*.
Supervisor: Prof. Dirk R. Englund, Quantum Photonics and AI Group

2019–2022 **Masters in Physics**, *ETH Zürich*.
CGPA : 5.41/6.00

2015–2019 **Bachelor of Technology (B.Tech)**, *Indian Institute of Technology (IIT) Madras*, Chennai.
CGPA : 9.58/10; Physics GPA: 9.82/10, Engineering Physics

2014–2015 **Higher Secondary Certificate**, *Delhi Public School*, Ranchi.
94.6%, Class XII, Central Board of Secondary Education

2012–2013 **Secondary School Certificate**, *Delhi Public School*, Ranchi.
CGPA : 10/10, Class X, Central Board of Secondary Education

Research Experience

Present **1. Massachusetts Institute of Technology**, *United States of America*, Research Associate (Full-time: 40hrs/week).
Working with **Prof Dirk Englund's** group, on spin opto-mechanical interfaces, and SnV color centers. Following are the aims:
- AI assisted co-design of quantum protocols and quantum repeaters
- Optimize a spin opto-mechanical interface for heralded entanglement protocol
- Developing protocols for MW single photon detection
- Collaborating with MITRE on piezo-driven color center platforms

Dec 2022 - June 2023 **2. Niels Bohr Institute**, *Copenhagen, Denmark*, Research Assistant (Full-time: 40hrs/week).
Worked with **Prof Peter Lodahl's** group, on designing, and simulating a microwave resonator for the coherent control of InGaAs quantum dots. Following were the aims:
- Designing a CPW resonator using gdspy framework
- B-field simulations on Comsol
- Characterization of the devices

Nov 2021 - July 2022 **3. Harvard University**, *United States of America*, Master's Thesis Project (Full-time: 40hrs/week).
Worked with **Prof Mikhail Lukin's** Silicon Vacancy subgroup, on Designing, Fabricating and Characterizing a Superconducting Coplanar Waveguide Quarter Wave Resonator for a Silicon Vacancy based Quantum Network Node. Following were the aims:
- Designing a SC CPW resonator using gdspy framework
- Simulating on Sonnet Software and loss modelling
- Learning the nano-fabrication steps and getting trained on the Harvard CNS tools for: Sputtering, Resist spinning, Photolithography, Developement, Lift-off, SEM, and Reactive Ion Etching
- Fabricating a number of resonators and using a flow cryostat and dilution fridge to characterize the resonator using a VNA
- Analyze the variation in Q-factor as a function of temperature and power

Mar 2021 - Jul 2021 **4. ETH Zürich**, *Switzerland*, Research Assistant (Part-time: 30hrs/week).
Worked with **Prof Christian Degen's** Spin Physics Group, under the supervision of **Dr. Takuya Segawa** on single particle distance measurements between 5-nm diamonds containing NV centers. Following were the aims:
- Confocal scans and ODMR are run on sample, to find good NV spots
- Two closest pairs of nanodiamond NV centers are selected using Super-resolution imaging
- Characterize individual NVs: ODMR contrast, Rabi frequency and coherence time T_2

Oct 2020 - Feb 2021 **5. ETH Zürich**, *Switzerland*, Semester project (Part-time: 30hrs/week).
Worked with **Prof Tilman Esslinger's** Quantum Optics. Group, under the supervision of **Dr. Abdulkadir Akin** on calibration of a gaussian laser beam via fast readout using FPGA and camera, for feedback stabilization. Following were the aims:
- Readout industrial camera with high FPS via USB
- Process pictures to determine position and waist of a Gaussian beam
- Control 2x Cameras with 1 FPGA to determine position, angle and focus shift of the beam

Full report can be found **here**.

Jun 2019 - Aug 2019 **6. Harvard University**, *United States of America*, Research Fellow (Full-time: 40hrs/week).
Worked with the DUNE Group, under the supervision of **Prof. Roxanne Guenette**, on the R&D of Anode Plane Assembly (APA) in the DUNE detector
- Developed a Python script using PyVISA (**Py**thon **V**irtual **I**nstrument **S**oftware **A**rchitecture) to control the experimental apparatus remotely
- Performed a remote electrical measurement of the anode wire length using Time Domain Reflectometry (TDR)
- Performed a remote tension measurement of the anode wire using bipolar resonance method and tested the working of my Python script

Full report can be found **here**.

Jun 2018 - Aug 2018 **7. CERN (European Organisation for Nuclear Research)**, *Switzerland*, Research Intern (Full-time: 40hrs/week).
Worked with the ATLAS Group, under the supervision of **Dr. Arely Cortes Gonzalez**, on the Laser and Cesium Calibration of the ATLAS Tile Calorimeter
- Studied and compared the laser and cesium measurements and evaluated the systematic uncertainty for the laser system, which is an important parameter for reconstructing back the energy deposited in the hadronic calorimeter.
- Measured the PMT response drift and its RMS variation over time
- This study will continue to include a comparison of Cesium – Laser for 2016 and 2017 (covering the full year).

Full report is present on the **CERN Document Server (CDS)**.

Contributed Works/Publications/Patents

1. Linsen Li, **Pratyush Anand**, Kaiming He, Dirk Englund, ***Dynamic Inhomogeneous Quantum Resource Scheduling with Reinforcement Learning*** , arXiv 2024

2. Hamza Raniwala, Stefan Krastanov, **Pratyush Anand**, Matt Eichenfield, Matthew Trusheim, Dirk R. Englund, ***A spin-optomechanical quantum interface enabled by an ultrasmall mechanical and optical mode volume cavity***, (**in preparation**)

3. **Pratyush Anand**, Ethan G. Arnault, Matthew Trusheim, Dirk R. Englund, ***Microwave single-photon detection using a hybrid spin-optomechanical quantum interface***, arXiv 2024

4. Stefano Marti, Enis Mustafa, Giacomo Bisson, **Pratyush Anand**, Philipp Fabritius, Tilman Esslinger, Abdulkadir Akin, ***FPGA-based real-time laser beam profiling and stabilization system for quantum simulation applications***, IEEE Xplore 2024

5. European Patent Application no. 23198811.4 (pending),
Pratyush Anand, Zhe Liu, Stefano Paesani, Leonardo Midolo, Anders Søndberg Sørensen, Peter Lodahl
A spin qubit system having a quantum dot

6. Dorothea Pinotsi, Rui Tian, **Pratyush Anand**, Koichiro Miyanishi, Jens Michael Boss, Kevin Chang, Pol Welter, Frederick Tze, Kit Tze Kit So, Daiki Terada, Ryuji Igarashi, Masahiro Shirakawa, Christian Degen and Takuya Fabian Segawa, ***"Distance measurements between 5-nanometer diamonds – Single particle magnetic resonance or optical super-resolution imaging?"***, Nanoscale Advances, Royal Society of Chemistry

7. Sebastien Prince, **Pratyush Anand**, James Battat, Russell Farnsworth, Nathan Felt, Roxanne Guenette, Shion Kubota, Austin Li, Em Murdock, John Oliver, Chris Stanford, Jackson Weaver, ***"Digital wire analyzer of mechanical tension, electrical continuity, and isolation"***, IEEE Transactions on Instrumentation and Measurement

8. **Pratyush Anand**, Arely Cortes Gonzalez, Attila Jozsef Rádl, ***"Cesium and Laser calibration of the ATLAS Tile Calorimeter"***, CERN Document Server (CDS) 2018

Conferences/Presentations

1. **Digital System Design (DSD) Euromicro Conference 2023**, Durres, Albania.
"FPGA-based real-time laser beam profiling and stabilization system for quantum simulation applications" is presented, also accepted for IEEE Xplore

2. **International Society of Magnetic Resonance Conference 2021**, online due to Covid.
"Distance measurements between 5-nanometer diamonds – Single particle magnetic resonance or optical super-resolution imaging?" is presented

3. **American Physical Society (Division of Particles and Fields) Meet 2019**, *Northeastern University*, Boston.
Represented the Harvard Neutrino Group and presented the poster titled "***Implementation of electrical wire-tension measurement method for liquid-argon time projection chambers***".

4. **CERN Summer Student Poster Session 2018**, Geneva, Switzerland.
"Cesium and Laser calibration of the ATLAS Tile Calorimeter" is presented.

Skills

- **Programming Languages:** C, C++, Python
- **Operating Systems:** Windows, Ubuntu Linux
- **Software & Packages:** QuTiP, ROOT, RooFit, MATLAB, Mathematica, AutoCAD, Verilog, Sonnet Software
- **Documentation:** LaTeX
- **Languages known:** English, Hindi, Sanskrit, German (Level A1)
- **Miscellaneous:** UCMAS (Universal Concept of Mental Arithmetic System)

Academic Achievements

- Received an **Honorable Mention** for the poster presented in the meeting of the **American Physical Society** 2019.
- **One among 13 candidates** from India to become scholar-2019 of Inlaks Shivdasani Foundation & Narotam Sekhsaria Foundation for M.Sc. studies at ETH Zurich
- One among **top 4** students from India (and 140 all over the world) to get selected for the **CERN Summer Student Programme -2018**
- One among **top 196** students in India to get selected for **Summer Research Fellowship Programme - 2017** by Indian Academy of Sciences
- Received IIT Madras's **Institute Merit Prize 2016-19**
- Received the **Best Volunteer Award 2015-16** from National Service Scheme
- Secured an **All-India-Rank of 2257 (top 0.2%)** in Joint Entrance Examination-Advanced (JEE-Advanced) for getting into IIT's
- Awarded **National Top- 1%** Certificate for National Standard Examination in Physics - 2014-15, conducted by **Indian Association of Physics Teachers**
- Selected for **International Mathematics Olympiad Training Camp 2013,14**. Youngest among **top 30** students in India
- Awardee of **Regional Mathematics Olympiad- 2012,13**. Selected among **top 600** students in India

Certificates can be found **here**.

Miscellaneous

- Offered guidance to students regarding CERN Summer Student Program on my **YouTube channel**, which so far has generated **more than 11k views and 88 comments**