

# Praveen Sriram

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📄 [praveen5.github.io](https://praveen5.github.io)



## Education

Sept 2019– **Stanford University**, CA, USA.

Applied Physics Ph.D. student in the [Goldhaber-Gordon lab](#).

Jul 2014– **Indian Institute of Technology Bombay**, Mumbai, India.

Aug 2019 B.Tech. & M.Tech. (Dual Degree) in [Electrical Engineering](#) with specialisation in Microelectronics, GPA-**9.82/10**.

**Ranked 2<sup>nd</sup>/70** in Electrical Engineering, and **3<sup>rd</sup>/880** students in the Institute

## Publications & Conference Proceedings

- **P. Sriram**, S. S. Kalantre, K. Gharavi, J. Baugh, and B. Muralidharan. [Supercurrent Interference in Semiconductor Nanowire Josephson junctions](#). Phys. Rev. B **100**, 155431, Oct 2019
- Gopalkrishnan, M., Kandula, V., **Sriram, P.**, Deshpande, A., & Muralidharan, B. (2016) [A Bayesian view of Single-Qubit Clocks, and an Energy versus Accuracy tradeoff](#)
- M. Gopalkrishnan, V. Kandula, **P. Sriram**, A. Deshpande, and B. Muralidharan. [Bayesian view of single-qubit clocks, and an energy versus accuracy tradeoff](#). Phys. Rev. A, **96**, 032339, Sep 2017. (*updated & revised*) ; (**Presented** a talk at [Q-Turn 2018](#), Florianópolis, Brazil) [[Certificate](#)]

## Research

### *Areas of Interest*

Experimental condensed matter physics, Topological quantum systems, Hybrid superconductor-semiconductor nanoelectronics

### *Research Experience*

**Master's Thesis – Quantum Transport in Hybrid Superconductor-Semiconductor devices**

*Indian Institute of Technology Bombay & Institute for Quantum Computing, University of Waterloo*

**Supervisors – Prof. Bhaskaran Muralidharan & Prof. Jonathan Baugh**

*(presented at the APS March Meeting 2019; published in Physical Review B)*

- Employed the Keldysh Green's function formalism (NEGF) to model quantum transport in hybrid nanodevices; computed the Andreev Bound State spectrum and current-phase relationship for SNS devices
- Simulated the Critical Current Oscillations in nanowire Josephson junctions, resulting from subband supercurrent interference in presence of an axial magnetic field (Peierls substitution)
- Included disorder and scattering processes in the nanowire to model realistic junctions
- Conducted a literature review on quantum dot - nanowire architectures for Majorana Bound States

*May-Jul 2017* **Spin Qubits in Germanium Nanostructures & Circuit QED**, *Institute of Science and Technology, Austria (IST Austria).*

[Nanoelectronics Group](#), Prof. Georgios Katsaros

- Used a Scanning Electron Microscope (SEM) to image Germanium Hut Wire samples and designed hut wire devices using CAD tools.
- Performed DC transport measurements on the hut-wires at 4 Kelvin in a liquid He dewar interfaced with TU Delft electronics (QT designed instrumentation)

- Studied the theoretical aspects of circuit QED and superconducting Coplanar Waveguide Resonators in serving as quantum channels between spin qubits
- Designed Niobium resonators, performed FEM simulations on Sonnet to extract loaded quality factor & coupling rate and measured the spectral response of a Nb resonator centred at 7.5 GHz [[Report](#)]

Jun 2015– **Bayesian View of Quantum Clocks**, *Indian Institute of Technology Bombay*.

Apr 2017 [Prof. Manoj Gopalkrishnan](#) & [Prof. Bhaskaran Muralidharan](#)

- Conducted literature survey and secondary research on Quantum Information.
- Analysed the basic protocol of a quantum clock using an exponential random variable and a precessing spin as the clock apparatus.
- Conducted an information theoretic treatment of clock random variables and used Landauer's Principle to theorise an energy/accuracy tradeoff.
- Developed a Physical realisation of the Single Qubit Quantum Clock based on capacitively coupled Quantum Dots with Ferromagnetic contacts.
- **Accepted** for a talk at [ISIT 2016](#), Barcelona and [Q-Turn 2018](#), Florianópolis, Brazil

## Scholastic Achievements

- 2016, 2017 & 2018 **Institute Academic Prize**, for the highest GPA for (2015-16 & 2016-17), and second-highest GPA in 2018 (in the Electrical Engineering Department).
- 2016, 2018 Amongst 30 students worldwide selected to attend a Summer School on Modern Physics at **Universiteit Leiden**, The Netherlands, and Summer School on Quantum Information Processing at the **Institute for Quantum Computing**, University of Waterloo, Canada
- 2014 Secured All India Rank 642 in [IIT-JEE \(Advanced\)](#) out of 150,000 candidates, and offered admission in the Indian Institute of Technology Bombay
- 2014 Secured All India Rank 433 & State Rank 46 in [JEE \(Main\)](#) out of 1,500,000 candidates
- 2013 Amongst the top 1% of 30000+ who appeared for National Standard Examination in Physics and Chemistry (NSEP, NSEC); to qualify for the Indian National Physics and Chemistry Olympiad (INPhO, INChO) conducted by HBCSE
- 2012 Selected for the [INSPIRE](#) Science Camp (sponsored by the Department of Science & Technology, Government of India)
- 2012 Recognised by CBSE & Kendriya Vidyalaya Sangathan for securing CGPA 10 in [AISSE-2012](#)

## Scholarships & Awards

- 2019 Received the **Undergraduate Research Award** (URA 03) for exceptional work, both in quality and in extent, in the Dual Degree Project (2018-19).
- 2019 Awarded the EE **Department Color** for exceptional contribution towards the department.
- 2018 Received the [Undergraduate Research Award](#) of C\$6000 for pursuing research at the Institute for Quantum Computing, in the University of Waterloo (awarded to 21 students worldwide)
- 2018 Received the **Undergraduate Research Award** (URA 01) by IIT Bombay for [IRNSS](#) Receiver design
- 2017 Awarded a **Scholarship** of €3200 by the Austrian Agency for International Cooperation in Education and Research ([OeAD](#)) for pursuing research in IST Austria (awarded to 40 students worldwide)
- 2017 Received the Student Excellence Award of ₹1,00,000 by the Lions Club of North Bombay
- 2014 Awarded Scholarship for Higher Education (SHE) under INSPIRE by virtue of performance within top 1% of grade XII examination

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## Key Courses

<b>Physics</b>	Quantum Information & Computing, Introduction to Quantum Physics and Applications, Quantum Mechanics II, Theoretical Condensed Matter Physics, Applied Solid state Physics, Quantum Transport, Nanomagnetism & Spintronics, Physics of Nanoscale devices
<b>EE</b>	Quantum Control I & II, Nanoelectronics, VLSI Technology, Digital VLSI Design, Advanced Network Analysis, Analog Circuits, Communication Systems, Microprocessors, EM Waves, DSP, Control Systems
<b>CS</b>	Machine Learning, Data Structures & Algorithms, Operating Systems
<b>Math</b>	Group Theory, Calculus, Linear Algebra, Differential Equations I & II, Complex Analysis
<b>Statistics</b>	Data Analysis and Interpretation, Probability and Random Processes

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## International Schools & MOOC

- May 2018* **Undergraduate School on Experimental Quantum Information Processing (USE-QIP)**, *Institute for Quantum Computing, University of Waterloo, Canada.*  
Attended a 2-week school on the theoretical & experimental aspects of Quantum Information Processing; worked with 2-qubit algorithms on an NMR quantum computer
- Dec 2016* **Quantum Transport: Atom to Transistor**, *Global Initiative of Academic Networks (GIAN) Course at Jawaharlal Nehru University, New Delhi*, by Prof. Supriyo Datta.  
Attended a week-long course on Quantum Transport and the NEGF formalism
- Jul 2016* **Summer School on Modern Physics at All Scales**, *Universiteit Leiden, The Netherlands*, by Dirk Bouwmeester, Carlo Beenakker, Leiden Physics Faculty.  
Attended a 10-day summer school organised by the faculty of Leiden Institute of Physics (LION)
- Feb-May 2015* **Mastering Quantum Mechanics**, *Massachusetts Institute of Technology (MIT) on edX.org*, Prof. Barton Zwiebach.  
This second-level Quantum Mechanics course by MIT, taken as an online course ([verified student](#))

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## Course Projects

- Autumn 2017* **Majorana Fermions in Semiconductor-Superconductor Heterostructures**, *EE 751, Nanomagnetism & Spintronics* .
- Conducted a literature survey on the growing interest of observing Topologically non-trivial phases in hybrid nanostructures
  - Simulated a one-dimensional semiconductor nanowire with superconducting contacts and longitudinal magnetic field
  - Showed the appearance of zero energy excitations above a critical magnetic field, which potentially signals the transition to topologically non-trivial phase [[Poster](#)]
- Spring 2017* **Non-Uniform Heating in Nanoscale Devices Simulated by NEGF based Quantum Transport**, *EE 620, Physics of Transistors*.
- Simulated Quantum Transport in nanoscale devices using the Non-Equilibrium Green's Function
  - Modelled inelastic scattering processes by including electron-phonon interactions
  - Demonstrated the non-uniform heating in a device with a potential barrier [[Poster](#)]
- Spring 2017* **Desi Shazam - A Song Recognition Tool**, *EE 338, Digital Signal Processing*.
- Used Short-Term Fourier Transform (STFT) to build the spectrogram of a song.
  - Taking inspiration from Shazam, we employed the technique of Audio Fingerprinting based on local peaks in the spectrogram
  - Using the correlation function, reported a song in the database with the highest correlation peak
  - Project selected as an **Excellent Presentation** of the application of Digital Signal Processing

- Spring 2017 & 2018* **Full-Stack Receiver Design for the Indian Regional Navigation Satellite Service (IRNSS)**, *EE 344, Electronic Design Lab.*
- Designed, Simulated, Fabricated and Tested a prototypical hardware front-end receiver.
  - Designed the S-band square-patch antenna, Analog-Front End, and fabricated PCBs for Low-Noise-Amplifier (LNA), SAW Filter, gain stages, and Low-Pass Filter
  - Successfully tested the Front End with IRNSS Satellites for acquisition of Navigation bits
  - Developed software for identification and decoding of uncorrupted subframes and for the extraction of various orbital parameters for location estimation and time offset correction
- Spring 2018* **Unsupervised Learning with Synthetic Sensors**, *Introduction to Machine Learning.*  
Designed a general-purpose sensor board, extracted the features & used K-means, Gaussian clustering to detect and classify 3 events [\[Report\]](#)
- Autumn 2016* **Noise-Sensitive Adaptive Modulation using GNU Radio**, *Communication Lab.*
- Implemented a Noise-Sensitive Modulation Scheme on GNU Radio which switches between QPSK and 8PSK depending on the noise in the channel.
  - Synchronized the transmitted and received symbols to measure the Bit Error Rate. [\[Report\]](#)
- Autumn 2016* **RISC Processor Design**, *Microprocessor Lab.*
- Designed a [Multicycle](#) and [6-stage Pipelined](#) implementation of a RISC Processor with given ISA.
  - Simulated & Synthesized the design, and tested on FPGA Board at 50 MHz .
- Spring 2016* **Using a CPLD Card to Capture and Display Analog Signals**, *Digital Circuits Lab.*  
Interfaced the CPLD card with ADC, SRAM and DAC chips to capture and display analog signal at a predetermined sampling rate. Used VHDL for the design of the digital circuit

## Skills & Experience

Programming	C/C++, Python, HTML, VHDL, Assembly
Science	QISKit, QCoDeS, MATLAB, Mathematica, Scilab, Octave, Tensorflow, NumPy, SciPy
Software	L <sup>A</sup> T <sub>E</sub> X, ngSPICE, AutoCAD, EAGLE, Sonnet, Synopsys - TCAD, Cadence - Virtuoso ADE
Electronics	RF-Reflectometry, Network Analyser, Signal Analyser, Oscilloscope, AWG, filter design

## Postions of Responsibility

- 2018–2019 **Department Academic Mentor**, *Electrical Engineering.*
- A mentor to academically weak students; helping them improve their performance
  - Serving as a communication channel between the faculty and students for grievance redressal
- 2016–2017, 2018– **Teaching Assistant**, *Quantum Physics, Differential Equations, Linear Algebra.*
- Mentoring a batch of 50 students with the course content
  - Conducted weekly tutorials and involved in grading of quizzes/exams
- 2015–2016 **Convener, Maths and Physics Club**, *Students' Technical Activities Body.*
- Involved in the ideation and execution of events, as well as online activity for Maths and Physics Club – a hobby club which organises various events throughout the year for the community of science enthusiasts on campus
- 2015 **Coordinator, Team Media, Mood Indigo**, *IIT Bombay's Annual Cultural Festival.*
- Involved in coordinating media relations and in getting deals with sponsors for Mood Indigo

## Extracurriculars

- 2017 Secured 1st Position in [MIMAMSA](#) 2017, IISER Pune's Science Quiz competition for undergraduates
- 2015 Passed with Distinction [ABRSM](#) (Royal School of Music, London) Grade 5 in Music Theory
- 2013 Passed [Trinity College](#) London's Music Examination: Keyboard Grade 1