Sriram Gopalakrishnan

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EDUCATION

- **Indian Institute of Technology Madras** — Chennai, India
  B.Tech. in Engineering Physics — Aug 2016 - May 2020
  Cumulative GPA: Physics: 9.29/10, Overall: 8.69/10
  Department Rank: 4 (class of 28 students)

- **AECS Magnolia Pre-University College** — Bangalore, India
  12th Grade: Physics, Chemistry, Mathematics, Computer Science — Apr 2016
  Score: 94.5%

RESEARCH EXPERIENCE

- **Indian Institute of Technology Madras** — Chennai, India
  Bachelor's Thesis Project: Vector-based 3D FEM for Microwave Remote Sensing — Aug 2019 - Present
  Advisor: Dr. Uday Khankhoje — Electromagnetics Group

  - Working towards long-term goal of detecting Lunar Subsurface Ice using RADAR backscattering data
  - Developing a vector based Finite Element Method for the forward model in 3D, entailing mathematical formulation and implementation in C++ [Report]
  - Currently verifying the analytical Mie Series solution for scattering from a homogeneous sphere

- **Tata Institute of Fundamental Research (TIFR)** — Mumbai, India
  Circular bus architecture for Superconducting Qubits — May - Jun 2019
  Advisor: Dr. Rajamani Vijayaraghavan — Quantum Measurement and Control Lab

  - Studied the theory of Circuit QED with Superconducting Qubits, and related Microwave Engineering
  - Optimized the design of a novel circular bus cavity for maximum inter-qubit coupling using microwave simulations: the geometry can be used to couple up to 5 qubits efficiently
  - Awarded **Best Project** in the Department of Condensed Matter Physics and Material Science [Slides]

- **Homi Bhabha Center for Science Education (HBCSE)** — Mumbai, India
  Electronic structure of a 2D Quantum Dot — Dec 2018 & Jul 2019
  Advisors: Dr. Praveen Pathak and Dr. Vijay Singh

  - Approximated the Landau levels of a circular Quantum Dot placed in a perpendicular magnetic field
  - Demonstrated the significance of using the BenDaniel-Duke boundary condition in the analysis
  - Numerical results find agreement with experiment on the InGaAs-GaAs Quantum Dot

- **Homi Bhabha Center for Science Education (HBCSE)** — Mumbai, India
  Quantum many-body theory — May - Jun 2018
  Advisors: Dr. Praveen Pathak and Dr. Vijay Singh

  - Studied variational and mean-field approaches to solving many-electron systems, including the Thomas-Fermi model, Hartree-Fock method and Density Functional Theory (DFT)
  - Examined the effect of doping nanoscale Silicon clusters on the valence orbitals using DFT simulations

HONORS AND AWARDS

- VSRP Scholar, Tata Institute of Fundamental Research   2019

- NIUS Scholar, Homi Bhabha Center for Science Education   2018

- KVPY Fellowship, Department of Science and Technology, Government of India   2016

  - Ranked 291st out of 50,000+ applicants in India

- Qualified the National Standard Examinations (NSEs) that lead to the selection of the   2015
  Indian delegation for the International Science Olympiads

  - **Physics**: National top 1% (44,000 participants)
  - **Chemistry**: State top 1% (state of Karnataka)
  - **Astronomy**: State top 1% (state of Karnataka)

PUBLICATIONS

- **Influence of the BenDaniel-Duke boundary condition on the levels of a circular Quantum Dot in a magnetic field** [PDF]
  P. Pathak, **G. Sriram**, S. Biswas and S. Handa
  Under peer-review in **Physica E**

COURSE PROJECTS

- **Quantum capacities of channels with small environment** [Slides]   Jan - Apr 2019
  PH5842: Advanced Topics in QCQI

  - Surveyed literature on the Quantum Capacity of extremal qubit channels
  - Studied the regime in which simple closed form expressions for the Quantum Capacity can be obtained

- **The Tent Map** [Slides]   Jan - Apr 2019
  PH5500: Dynamical Systems

  - Surveyed literature on the application of chaotic tent maps in image encryption
  - Studied the periodicity and chaos of the 1D Tent Map in Mathematica
  - Observed that prime orbits of arbitrarily high period are born at the very first bifurcation of the map
  - Plotted an approximate bifurcation diagram of the map in Python

- **Constrained Optimization in CVX**   Jan - Apr 2019
  EE5121: Convex Optimization

  - Used the CVX module in MATLAB to solve three practically significant optimization problems:
    * Recovering a Piecewise Constant signal from a noisy measurement
    * Resource limited revenue maximization
    * Low-rank matrix completion

- **Superconducting Qubits** [Slides]   Jul - Nov 2018
  PH5840: Quantum Computation and Quantum Information

  - Surveyed literature on the parallel between Superconducting Qubits and Quantum Harmonic Oscillators
  - Studied how the non-linearity of the Josephson Junction manifests in unequal level spacings

LAB PROJECTS

- **Electro-optic Kerr Effect** Jan - Apr 2019

    - Verified the electro-optic Kerr Effect by determining the Kerr constant of a PLZT sample using a diode laser optical setup and presented findings

- **Ultrasonic Wave Velocity in Liquids** Jan - Apr 2019

    - Determined the wave-velocity of 2MHz ultrasound in Benzene and Water using a high-precision ultrasonic interferometer and presented findings

- **Photoconductivity of a Cadmium Sulphide Photoresistor** Jul - Nov 2018

    - Measured the Current-Voltage and Current-Incident Intensity characteristics of a Cadmium Sulphide photoresistor by constructing an optical setup and presented findings

- **Synchronized Light and Sound System** Jan - Apr 2018

    - Constructed a composite analog circuit to synchronize an LED with 1kHz and 3kHz audio inputs
    - Modules included a DC-DC converter based LED Driver (negative feedback compensated), a Class D Audio Amplifier, Active Bandpass filters (1kHz & 3kHz) and a Peak Detector

SKILLS

- **Programming Languages**: C++, Python

- **Scientific Packages**: MATLAB, Mathematica, LaTeX, COMSOL Multiphysics, AWR Microwave Office

SELECTED COURSEWORK

- **Physics (undergraduate level)**: Classical Mechanics, Electrodynamics, Electromagnetics and its Applications, Statistical Physics, Quantum Mechanics, Solid State Physics

- **Physics (graduate level)**: Physical Applications of Stochastic Processes*, Coherent and Quantum Optics*, Advanced Statistical Physics, Condensed Matter Physics II, Quantum Computation and Quantum Information (QCQI), Advanced Topics in QCQI, Dynamical Systems

- **Mathematics**: Multi-variable Calculus, Probability Statistics & Stochastic Processes, Mathematical Physics, Convex Optimization