Supratik Sarkar | Curriculum Vitae

Joint Quantum Institute, University of Maryland
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Education

Joint Quantum Institute, University of Maryland — **College Park, MD, USA**
PhD in Electrical and Computer Engineering — *2021 onwards*
Supervisor: Prof. Mohammad Hafezi

Institute for Quantum Computing, University of Waterloo — **Waterloo, ON, Canada**
MASc in Electrical and Computer Engineering (Quantum Information) — *2019 - 2021*
Percentage: 96.20/100 (CGPA: 4/4)
Thesis: "Creating and shaping light at single photon level"
Supervisor: Prof. Michal Bajcsy

Jadavpur University — **Kolkata, WB, India**
Bachelor of Engineering (B.E.), Electronics and Tele-communication Engineering — *2014 - 2018*
CGPA: 9.26/10 (Passed First Class with Honours)
Bachelor Project: "Tunneling in Graphene SymFETs"
Supervisor: Prof. Chayanika Bose

Research Interests

- Atomic, Molecular and Optical (AMO) Physics
- Nanophotonics
- Condensed Matter Physics
- Quantum Information Theory and Quantum Computing

Manuscripts

Peer-reviewed publications

- Mattia Walschaers, **Supratik Sarkar**, Valentina Parigi, and Nicolas Treps. **Tailoring Non-Gaussian Continuous-Variable Graph States**, Physical Review Letters 121, 220501 (2018), doi: 10.1103/physrevlett.121.220501.
- **Supratik Sarkar**, Samrat Sarkar, and Chayanika Bose. **Influence of polarization and self-polarization charges on impurity binding energy in spherical quantum dot with parabolic confinement**, Physica B: Condensed Matter, 541, 75-78 (2018), doi: 10.1016/j.physb.2018.04.035.

Thesis

- **Supratik Sarkar**. **Creating and shaping light at single photon level**, Master's Thesis, University of Waterloo, http://hdl.handle.net/10012/17024 (2021).
- **Supratik Sarkar**, and Samrat Sarkar. **Tunneling in Graphene SymFETs**, Bachelor's Thesis, Jadavpur University, arXiv: 1805.09659 (2018).

Conferences (Talks and Posters)

- **Supratik Sarkar**, Golam Bappi, Jinjin Du, Sreesh Venuturumilli, and Michal Bajcsy. **Creating non-classical states using deterministic single photon subtraction in waveguides and bi-modal cavities**, APS DAMOP (2021).
- **Supratik Sarkar**, Jinjin Du, and Michal Bajcsy. **Deterministic single photon subtraction for engineering**

exotic non-classical states of light, APS March Meeting (2020).

- Jeremy Flannery, Sema Kuru, **Supratik Sarkar**, Vinodh R. R. Muthu, and Michal Bajcsy. **Ultraviolet resonator integrated in a hollow-core fiber for Xenon plasma lasing**, APS March Meeting (2020).
- **Supratik Sarkar**, Jinjin Du, and Michal Bajcsy. **Deterministic single photon subtraction using solid state emitters coupled to chiral waveguides**, in Frontiers in Optics + Laser Science APS/DLS, doi: 10.1364/FIO.2019.JTu3A.37 (2019).
- Vinodh R. R. Muthu, **Supratik Sarkar**, Behrooz Semnani, and Michal Bajcsy. **Antenna Model For Metasurface-Assisted Enhancement Of Light-Matter Interaction**, in Frontiers in Optics + Laser Science APS/DLS, doi: 10.1364/FIO.2019.JW3A.81 (2019).

Symposiums and Workshops

- Deterministic Single Photon Subtraction. Waterloo-HKUST Workshop on Emerging Quantum Technologies in Solid-State and Atomic System Workshop (*Jul 2019*)
- Deterministic Single Photon Subtraction, and Antenna Model for Metasurface-Assisted Enhancement of Light-Matter Interaction. Celebratory Waterloo-Rochester Photonics Symposium (*Jul 2019*)
- Demonstrated my cell phone controlled drone at National Symposium On Internet of Things: Trends and Opportunities Ahead NSIoT 2016 organized by Institution of Engineering and Technology (UK), Kolkata Local Network and Electrical Engineering Department, Jadavpur University (*2016*)

Research Experience

PhD Research

- **Optically probing strongly correlated electron states**
  - **Description**: We aim to optically study exotic excitonic and correlated states in systems with significant on-site Hubbard interactions, like twisted bilayer Transition Metal Dichalcogenides (TMDs), high Tc superconductors, etc. We are interested in exploring quantum Hall physics, and correlated electronic states in these materials.

- **Studying cooperative effects in Gallium Arsenide (GaAs) waveguides**

Masters Research

- **Deterministic single photon subtraction using SPRINT in a three-level emitter for engineering exotic non-classical states of light**
  - **Description**: We perform analytical and numerical analysis of deterministic single photon subtraction from any arbitrary state of light using single photon Raman interaction (SPRINT) in a single quantum emitter coupled with a chiral waveguide, or a bi-modal cavity. We also investigate the performance of recently reported emitter-waveguide systems as a photon subtractor for different kinds of input light. Furthermore, we studied how this mechanism can be used to engineer non-classical exotic states of light that have applications in quantum information theory, and metrology.

- **Designing optical antennas with Inverse Design for enhanced directional emission of radiation from NV centers**
  - **Description**: We employed adjoint optimization and inverse design techniques to design diamond nanophotonic devices that help in directional emission of radiation from nitrogen vacancy centers in diamonds. Our design gives us a higher collection efficiency compared to existing techniques.

- **Design and fabrication of photonic crystal mirrors for making fiber-integrated gas lasers**
  - **Description**: We designed and fabricated photonic crystal mirrors for making fiber-integrated Xe laser operating in the ultraviolet (UV) region when exposed to RF discharge.

Undergraduate Research

- **Bachelor's Degree Project: Tunneling in Graphene SymFETs** (*2017 - 2018*)
  - **Supervisor**: Prof. Chayanika Bose, Jadavpur University
  - **Report**: Supratik Sarkar, and Samrat Sarkar, Tunneling in Graphene SymFETs, arXiv: 1805.09659 (2018).

- **Single Photon Subtraction from Continuous Variable Cluster States** (*2017*)
  - **Supervisors**: Prof. Nicolas Treps, and Prof. Valentina Parigi, Multimode Quantum Optics Group, Laboratoire Kastler Brossel (CNRS, ENS, UPMC-Sorbonne)
  - **Publication**: Mattia Walschaers, Supratik Sarkar, Valentina Parigi, and Nicolas Treps. Tailoring Non-Gaussian Continuous-Variable Graph States, Physical Review Letters 121, 220501 (2018), doi: 10.1103/physrevlett.121.220501.

- **Influence of Polarization and Self-polarization Charges on Impurity Binding Energy in Spherical Quantum Dot with Parabolic Confinement** (*2016 - 2017*)
  - **Supervisor**: Prof. Chayanika Bose, Jadavpur University
  - **Publication**: Supratik Sarkar, Samrat Sarkar, and Chayanika Bose. Influence of polarization and self-polarization charges on impurity binding energy in spherical quantum dot with parabolic confinement, Physica B: Condensed Matter, 541, 75-78 (2018), doi: 10.1016/j.physb.2018.04.035.

- **Detection of Celiac Disease from Endoscopy Images Using Convolutional Neural Networks** (*2016*)
  - **Supervisor**: Prof. Debdoot Sheet, Indian Institute of Technology Kharagpur

- **True Random Number Generators** (*2015*)
  - **Supervisor**: Prof. Subhamoy Maitra, Indian Statistical Institute, Kolkata

Teaching Assistantship

- **ECE 404: Geometric and Physical Optics** *Winter 2020*
  - **Instructor**: Prof. Michal Bajcsy, University of Waterloo

Awards & Scholarships

- Recipient of Dean's Fellowship, given by University of Maryland (*2021*)
- Recipient of the WIN Nanofellowship, given by Waterloo Institute for Nanotechnology (*2020*)
- Recipient of the Faculty of Engineering (FOE) Award, given by Department of Electrical and Computer Engineering, University of Waterloo for excellence in academic performance and research (*2020*)
- Recipient of the International Masters Student Award, given by University of Waterloo (*2019*)
- Recipient of the Graduate Research Studentship (GRS) funding, given by University of Waterloo (*2019*)
- Recipient of the Charpak Masters Scholarship, given by Government of France to pursue Masters in France (*2018*)
- Recipient of Centre National de la Recherche Scientifique (CNRS) Internship funding for being an intern at Laboratoire Kastler Brossel (LKB), Paris, France (*2017*)
- Recipient of Certificate of Merit, given by Minister of Human Resource Development, Govt. of India for being among the top 0.1% of candidates in Biology in All India Senior School Certificate Examination (*2014*)

Technical Skills

- **Nanofabrication**
  Electron beam lithography (EBL), electron beam and thermal physical vapour deposition (PVD), reactive ion etching (RIE), spin coating, reflectrometry, acid wetbench, solvent wetbench, characterizing microscopes
- **Programming languages and softwares**

C, C++, C#, Python, Torch, SQL, Verilog, Unix, MATLAB, GNU Octave, Mathematica, Lumerical, Qiskit, Qutip, Tensorflow

Extracurricular Activities

- **Executive member, Institute for Quantum Computing Graduate Student Association (IQC GSA)**
  Lead the event organizing team of IQC GSA (*2019 - 2020*)
- Collaborated with Aquanty, to develop deep learning techniques for hydrological forecasting (*2019*)
- **Convener, Jadavpur University Science Club (JUSC)**
  Organized scientific seminars, guest lectures, hands-on tutorial sessions on robotics, electronics, and computer programming (*2015 - 2018*)
- **Organizing committee member, Srijan**
  Member of the organizing committee of Srijan, the annual techno-management fest of Jadavpur University (*2017*)