Siddharth Paul

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Education

Rutgers University, New Brunswick, NJ September 2023 - May 2027
B.S. in Physics | B.S. in Computer Science | Minor in Mathematics
Relevant Coursework
Physics: Advanced General Physics I & II, Modern Physics, Modern Optics, Thermal Physics, Modern Instrumentation, Computer-Based Experimentation, Research in Physics
Mathematics & Computation: Advanced Calculus for Engineering, Differential Equations for Engineering & Physics, Linear Algebra, Multivariable Calculus, Discrete Structures I & II, Data Structures

Research Interests

My research investigates point-defect physics in wide-bandgap and two-dimensional quantum materials, with a focus on engineering optically addressable spin defects for quantum sensing and quantum information applications. In the Q-Sim Laboratory, I study VB^- spin defects in hexagonal boron nitride generated via helium-ion irradiation, using SRIM/TRIM Monte Carlo simulation to model vacancy generation and guide irradiation parameters, and characterizing the resulting defects through optically detected magnetic resonance and confocal photoluminescence spectroscopy. This work sits at the intersection of defect engineering, materials fabrication, and quantum optical characterization. I am broadly interested in extending these methods to other 2D and wide-bandgap host materials as platforms for scalable quantum sensing and quantum information technologies.

Research Experience

Q-Sim Laboratory - Rutgers University Piscataway, NJ
Undergraduate Researcher, advisor Prof. Shaowen Chen September 2025 - Present
Investigate VB^- spin defects in hexagonal boron nitride (hBN) generated via helium ion implantation, correlating irradiation dose with defect yield, spin coherence properties, and single-photon emission behavior.

Sample Fabrication

- Perform polycarbonate (PC)- and PVA-based dry-transfer stacking of exfoliated 2D flakes to assemble heterostructures, preparing samples for subsequent helium-ion irradiation and optical characterization.

Simulation & Modeling

- Run SRIM/TRIM Monte Carlo simulations to model vacancy generation and ion stopping profiles, developing fluence-to-vacancy conversion frameworks used to select irradiation parameters.

Optical Characterization

- Perform optically detected magnetic resonance (ODMR) and confocal photoluminescence spectroscopy to characterize single-photon emitter behavior and spin defect signatures across irradiated sample regions.

Data Analysis & Pipelines

- Build Python pipelines (NumPy, SciPy, Matplotlib) for spatial PL map processing, ROI extraction, and spectral peak analysis across irradiated sample sets.

Mentorship

- Mentored an Aresty-funded undergraduate researcher over the summer, onboarding her onto the hBN defect project and training her in ODMR spectroscopy, sample preparation, and SRIM/TRIM simulation, while reviewing her data and analysis to help develop her independent experimental skills.

Skills

Experimental Techniques: Confocal photoluminescence microscopy, optically detected magnetic resonance (ODMR), grating spectrometer operation, nanopositioning stage control, helium ion irradiation, sample handling; 2D material dry-transfer fabrication (PC and PVA stamp methods), circuit-level instrumentation, RLC/resonant circuit analysis, op-amp instrumentation amplifier design, thermistor-based temperature sensing and calibration, DAC/ADC signal conversion

Instrument Control & Data Acquisition: LabVIEW (Virtual Instrument design), GPIB-based automated data acquisition

Simulation & Modeling: SRIM/TRIM Monte Carlo simulation (ion stopping, vacancy generation, fluence-to-dose modeling)

Computation & Signal Analysis: Python (NumPy, SciPy, Pandas, Matplotlib), MATLAB (Fourier analysis/synthesis, signal decomposition), C++; statistical analysis, regression, curve fitting, signal-to-noise analysis; spatial PL mapping, ROI extraction, spectral peak analysis

Tools: LaTeX, Git, Linux

Presentations & Outreach

Guest Speaker — IEEE Rutgers Annual Banquet 2026

Guest Speaker — IDEA Program for Prospective ECE Students 2026

Keynote Speaker — NJASCD Conference 2023

Presented on applying AI and conversational chatbot technology to support educators.

Leadership & Work Experience

IEEE-VEXU Piscataway, NJ

President & Build Lead January 2025 - Present

- Direct a 25+ person technical team across mechanical design, electrical systems, and programming sub-teams through a full annual build-to-competition cycle, owning final technical deliverables under a fixed, externally imposed competition deadline, independently managing scope, timeline, and cross-functional integration.
- Secure project funding through direct outreach to equipment/component manufacturers for sponsorships and by writing funding proposals to multiple university departments, in addition to competition travel grant procurement for Worlds qualification, culminating in a Top 20 global finish at VEX U Worlds.
- Train incoming members across mechanical, electrical, and programming sub-teams, onboarding them into the team's build process and technical workflows.

Iconectiv Ericsson Bridgewater, NJ

Software Engineering Intern June 2025 - August 2025

- Built Python microservices streaming distributed-system telemetry from 8 internal systems into real-time dashboards, replacing manual log inspection and cutting monitoring pipeline runtime 20%.
- Integrated Tenable, GitHub, and lifecycle-management APIs into one centralized compliance pipeline, surfacing live CVE, ownership, and patch data for 5+ engineering teams.

Iconectiv Ericsson Bridgewater, NJ

Software Development Intern June 2024 - August 2024

- Built a DevOps monitoring platform mapping 200+ enterprise applications and their interdependencies, replacing a recurring manual audit with continuous automated dependency checks.
- Engineered Python modules for update orchestration and security patch management, compressing patch deployment cycles from weeks to hours.

Awards & Recognition

VEX Robotics World Championship 2025 - 2026

Top 20 Global Finish

Led SCAR Robotics as President and Build Lead, managing roster selection, travel grant procurement, and end-to-end robot development pipeline.

HackRU 2024 2024

First Place

Developed Holobrain, a real-time AR neuroanatomy visualization tool using computer vision hand tracking (MediaPipe, OpenCV) for gesture-controlled 3D model manipulation in Unity/C#, awarded 1st Place at HackRU 2024.

Congressional App Challenge Winner 2023

Won the Congressional App Challenge (NJ-06), the U.S. House of Representatives' nationwide student software competition, for Myndful — an AI-powered mental health chatbot deployed to 6,000+ students; recognized by Congress and exhibited on the U.S. House website.