Nathan Eli Miller

1133 Huff Rd NW, Apt 115, Atlanta, GA 30318
Phone: (+1) 941-961-9004, email: nathan.miller@gatech.edu

Current Fields of Interest

- *Quantum-classical computing hardware co-design*, including quantum devices, calibration, characterization, and FPGA-based control and readout systems.
- *Device physics,* including semiconductor and superconductor device and noise modeling.
- *High performance algorithms* in beyond-CMOS hardware including machine learning.

Education

2019-2024	**Georgia Institute of Technology**	Atlanta, GA

- *Ph.D. in Electrical and Computer Engineering, Expected May 2024*
- GPA: 3.83
- Technical Interest Group: VLSI; Minor: Physics
- Thesis: Quantum-Classical Co-Design with Machine Learning Applications
- Advisor: Dr. Saibal Mukhopadhyay, Joseph M. Pettit Professor, School of Electrical and Computer Engineering

2019-2022	**Georgia Institute of Technology**	Atlanta, GA

- *Master of Science in Electrical and Computer Engineering, May 2022*
- GPA: 3.83
- MS Thesis: Impact of HKMG and FDSOI FeFET Drain Current Variation in Processing-in-Memory Architectures
- Advisor: Dr. Saibal Mukhopadhyay, Joseph M. Pettit Professor, School of Electrical and Computer Engineering

2014-2019	**University of Florida**	Gainesville, FL

- *Bachelor of Science in Electrical Engineering, Summa Cum Laude, May 2019*
- GPA: 3.90
- Minor: Mathematics
- Undergraduate Thesis: Simulating the Effects of Mechanical Stress on Hall-Effect Sensor Devices
- Advisor: Dr. Mark Law, Distinguished Professor and Director of the UF Honors Program, Department of Electrical and Computer Engineering

Awards

2021 **National Defense Science and Engineering Graduate (NDSEG) Fellowship**

- Awarded by the Department of Defense and sponsored by the Air Force Research Laboratory/Air Force Office of Scientific Research. Three year graduate fellowship awarded to individuals who have demonstrated ability and special aptitude for advanced training in science and engineering, including full tuition and fee coverage, health insurance stipend, monthly stipend and travel budget, as well as mentorship from a researcher in the sponsoring agency

2021 **Certificate of Quantum Excellence**

- Awarded by the IBM Qiskit Global Summer School on Quantum Machine Learning for successful completion of the course and all laboratory exercises.

2019 **Georgia Institute of Technology Halina and Aleksander Szlam Fellowship Endowment for the School of Electrical and Computer Engineering, 2019-2020**

- Scholarship award for the first year of graduate studies for selected students.

2019 **UF Department of Electrical and Computer Engineering "Electric E" Award**

- Awarded to students graduating with 3.90+ GPA (awarded to three students in Spring 2019).

2018 **UF Herbert Wertheim College of Engineering Addison Pound Scholarship**

- Scholarship award for the 2018-2019 year based on performance in the UF HWCOE.

2018 **Helen E. Khouri Memorial Scholarship in Electrical and Computer Engineering**

- Scholarship in the UF Department of ECE for the 2018-2019 academic year.

2017 **UF University Scholars Program 2017-2018**

- Stipend awarded by the College of Engineering to perform and present undergraduate research.

2016 **UF Department of Electrical and Computer Engineering Ralph Sais Scholarship**

- Scholarship for a selected student for the 2016-2017 academic year.

Various **UF College of Engineering Dean's List**

- Selected for top academic performance in Spring 2015, Fall/Spring 2016, Fall/Spring 2017 and Fall 2018.

2014 **Florida Bright Futures: "Florida Academic Scholars" (FAS) Scholarship**

- In-state tuition coverage for undergraduate students based on high school academic merit and community service for the duration of undergraduate studies (2014-2019).

2014 **Bradenton Herald "Golden Herald" First Place Computer and Technology Category**

- Community scholarship awarded to one student entering undergraduate studies in the fields of computing and technology based on academic merit and community service.

Academic Research Experience

2019-present **Georgia Institute of Technology**   Atlanta, GA

NDSEG Fellow, PhD Student – Gigascale Reliable Energy-Efficient Nanosystems (GREEN) Laboratory under Prof. Saibal Mukhopadhyay

My research is focused on various beyond-CMOS computing platforms and their applications to machine learning acceleration. This includes current work in quantum computing, including designing an FPGA-based tomography accelerator and a quantum Hopfield associative memory, as well as developing calibration protocols for quantum computing hardware in collaboration with the Quantum Performance Laboratory at Sandia National Laboratories. Additionally, my MS Thesis work studied the reliability of deep neural network (DNN) accelerators based on Ferroelectric FET (FeFET) technology.

2016-2019   **University of Florida**   Gainesville, FL

Research Assistant, University Scholars Program Honoree – Software Analysis and Advanced Materials Processing (SWAMP) Center under Prof. Mark Law

My undergraduate research was a collaborative project with Texas Instruments studying the effects of mechanical stress from packaging and other sources on semiconductor devices such as Hall-effect sensors and BJTs. I led a group of multiple graduate and undergraduate students and presented our work at Texas Instruments' campus in Dallas, TX in 2018, as well as publishing the work as an undergraduate thesis.

Publications

Published and Accepted Journal Papers (refereed)

[1] N. E. Miller and S. Mukhopadhyay, "A Quantum Hopfield Associative Memory Implemented on an Actual Quantum Processor," *Sci Rep* **11**, 23391 (2021).

[2] N. E. Miller, Z. Wang, S. Dash, A. I. Khan and S. Mukhopadhyay, "Impact of HKMG and FDSOI FeFET drain current variation in processing-in-memory architectures," *Journal of Materials Research* **36**, 4379-4393 (2021).

Published Conference Papers (refereed)

[3] N. E. Miller, B. Chakraborty and S. Mukhopadhyay, "A Reconfigurable Quantum State Tomography Solver in FPGA," *2023 IEEE International Conference on Quantum Computing and Engineering (QCE),* Bellevue, WA, pp. 1412-1421 (2023).

[4] N. E. Miller and S. Mukhopadhyay, "Quantum State Tomography in FPGA," *Optica Quantum 2.0 Conference and Exhibition*, paper QTu3A.1 (2023).

[5] N. E. Miller, Z. Wang, S. Dash, A. I. Khan and S. Mukhopadhyay, "Characterization of Drain Current Variations in FeFETs for PIM-based DNN Accelerators," *2021 IEEE 3rd International Conference on Artificial Intelligence Circuits and Systems (AICAS),* pp. 1-4 (2021).

Manuscripts in Preparation

[6] A. B. Magann, N. E. Miller, R. Blume-Kohout and K. C. Young, "Feedback-based Calibration for Automatic Tuning and Drift Control for Quantum Processors"

[7] N. E. Miller, A. B. Magann, D. Lobser, S. Clark, R. Blume-Kohout and K. C. Young, "Automatic Tuning and Drift Control of Trapped-Ion Quantum Processors"

Industry and National Laboratory Experience

2023-Present **Sandia National Laboratories** Albuquerque, NM

Graduate Intern – Quantum Computer Science

- Graduate R&D Intern focused on the calibration and characterization of quantum computing hardware using both simulation methods in PyGSTi and RFSOC/FPGA-based control of the QSCOUT trapped ion quantum testbed

- Developing rapid stochastic calibration protocols for quantum systems capable of on-line and off-line calibration

- Contributing to the development of novel quantum computing modeling software capabilities in PyGSTi

2019-2019 **Intel Corporation** Folsom, CA

Graduate Technical Intern – Nonvolatile Memory Systems Group

- Worked in the Technology Development Quality and Reliability team and designed tests and models predicting early failure modes of 3DXP memory devices.
- Analyzed the effect of device-level thermal disturb on 2nd Generation Intel Optane component cells.

2018-2018 **Intel Corporation** Folsom, CA

Undergraduate Technical Intern – Nonvolatile Memory Systems Group

- Worked in the NAND Quality and Reliability team and developed 3D NAND electrical failure analysis testbench libraries for TLC and QLC components.

2017-2017 **Intel Corporation** Hillsboro, OR

Undergraduate Technical Intern – Devices Development Group

- Worked in the Fullchip Validation team to develop a series of pre-Silicon SoC tests to validate memory ordering functionality on Skylake, Kaby Lake and Tiger Lake processor generations.
- Applied TDD/SWIFT principles to enhance software craftsmanship and reduce complexity for high order algorithms.

2016-2016 **General Electric Aviation** Cincinnati, OH

Services, Performance and Analytics Intern

- Developed advanced Services Engineering metrics, tracking and employee interfacing via the creation of multiple websites and automated data analytics processes

2015-2015 **General Electric Aviation** Lynn, MA

Supply Chain Intern, Rotating Parts Manufacturing Operations Assistant Manager

- Maximized efficiency and safety of a manufacturing floor with 30 union employees and weekly output over $750,000.
- Tracked parts, tooling and gages for manufacturing throughput and maintenance of CNC mill and lathe machines.
- Performed measurements of jet engine fan disks for engineering quality reports.

Teaching Experience

Fall 2019   **Graduate Teaching Assistant** for Georgia Institute of Technology ECE 3400 (Analog Electronics). Held office hours, graded assignments, and conducted exams for undergraduate students.

Spring 2019   **Undergraduate Teaching Assistant** for University of Florida ECE 3396C (Solid State Electronic Devices). Led three laboratory sections as the sole TA for the course, gave a guest lecture, graded reports and exams, and held office hours.

Fall 2018   **Undergraduate Teaching Assistant** for University of Florida ECE 3396C (Solid State Electronic Devices). Led three laboratory sections as the sole TA for the course, graded reports and exams, and held office hours.

Spring 2018   **Undergraduate Teaching Assistant** for University of Florida ECE 3308C (Electronic Circuits I). Led a laboratory section, graded reports and exams, and held office hours.

Talks and Presentations

- **"Feedback-based calibration for tuning and drift control of a trapped-ion quantum processor,"** *APS March Meeting 2024,* Minneapolis, MN, Mar. 2024.
- **"Real-Time Feedback for Calibration of Quantum Processors,"** *MIT Lincoln Laboratories*, Lexington, MA, Feb. 2024.
- **"Beyond-CMOS Computing in the National Interest,"** *U.S. Army Research Laboratory Adelphi Laboratory Center*, Adelphi, MD, Nov. 2023.
- **"A Reconfigurable Quantum State Tomography Solver in FPGA,"** *2023 IEEE International Conference on Quantum Computing and Engineering (QCE),* Bellevue, WA, Sept. 2023.
- **"Feedback-based calibration for rapid tuning and drift control of quantum processors,"** *Assessing the Performance of Quantum Computers (APQC) Workshop 2023*, Estes Park, CO, Sept. 2023.
- **"Accelerated Quantum State Tomography with Machine Learning Applications,"** *National Defense Science and Engineering Graduate Fellows Conference 2023*, San Antonio, TX, Aug. 2023.
- **"Stochastic Quantum Calibration: Theory and Implementation,"** *Sandia Computer Science Research Institute Summer Intern Lightning Talks*, Albuquerque, NM, July 2023.
- **"Quantum State Tomography in FPGA,"** *Optica Quantum 2.0 Conference and Exhibition 2023*, Denver, CO, June 2023.
- **"An Introduction to Quantum Machine Learning,"** *Georgia Institute of Technology ECE8863: Quantum Computing Devices and Hardware*, Guest Lecture, Atlanta, GA, Apr. 2023.

- "**Characterization of Drain Current Variations in FeFETs for PIM-Based DNN Accelerators**," *2021 IEEE 3rd International Conference on Artificial Intelligence Circuits and Systems (AICAS)*, Virtual, June 2021.
- "**Impact of FeFET Drain Current Variation in Processing-in-Memory Architectures**," *2021 Virtual Materials Research Society Spring Meeting and Exhibit*, Apr. 2021.
- **"Carrier Mobility in Electric Fields,"** *University of Florida EEE3396C: Solid State Electronic Devices*, Guest Lecture, Gainesville, FL, 2018.
- **"Simulating the Effects of Mechanical Stress on Hall-Effect Sensors,"** *University of Florida Undergraduate Research Symposium,* Gainesville, FL, Apr. 2018.

Professional Activities

2024 **American Physical Society March Meeting Session Chair**
- 2024 Session Chair: "Quantum Characterization, Verification and Validation II"

2016 – Present   **Eta Kappa Nu Electrical and Computer Engineering Honor Society**
- Epsilon Sigma chapter Corresponding Secretary 2017-2018, Treasurer 2018-2019
- Assisted in planning the IEEE HKN Student Leadership Conference held at the University of Florida in Spring 2018.

2016 – Present   **Tau Beta Pi Engineering Honor Society**
- Florida Alpha chapter Vice President of the Electee Process Spring 2018

2019 – Present   **Georgia Tech Cru**
- Leading weekly Bible studies and social events for graduate students, member of Cru Graduate Fellows Program

2014 – 2016 **University of Florida AIAA Design, Build, Fly Competition**
- Competition team member and leader of the Avionics/Systems Team working on control systems and CAD design
- Raised industry sponsorship money for the team to attend the national competition in Tucson, AZ

Various   **Service Projects**
- Sandia Serves: worked with elementary-aged students to teach STEM principles with exciting but simple projects.
- Intel Involved: German Shepherd Rescue, various projects for underserved youth.
- GE Volunteers: homeless veterans' event, Habitat for Humanity, STEM Girl Scout Camp.
- Tau Beta Pi and Eta Kappa Nu projects including teaching grade school students engineering concepts.

University of Florida Electrical Engineering Senior Design Project

Spring 2019 – Designed a "Rock 'Em Sock 'Em Robots" style video game system from scratch including four-channel electromyography filtering from multi-user bicep flexion, stereo audio output for sound effects and background music, multi-threaded game control on an Atmel SAM4S microcontroller, FPGA to VGA graphics output, SRAM interfacing, and power management on custom-designed printed circuit boards fabricated from Altium designs.