

Anastashia Jebraeilli

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Research Interests

Open quantum systems; digital quantum simulation; non-Hermitian quantum dynamics; noisy intermediate-scale quantum devices; quantum sensing; waveguide-QED-inspired circuit models; tensor-network-assisted circuit compression; quantum error correction and fault-tolerant architectures.

Education

University of Georgia

Ph.D. in Physics; GPA: 3.83/4.0

Dissertation: *Quantum Simulation of Open and Noisy Quantum Systems*

Advisor: Dr. Michael R. Geller

Athens, Georgia

August 2019 – April 2026

University of Copenhagen, Niels Bohr Institute

Niels Bohr Quantum Summer School

Copenhagen, Denmark

Summer 2025

University of Georgia

B.S. in Physics and Astronomy; GPA: 3.5/4.0

Minor: Chinese Language and Literature

Athens, Georgia

August 2015 – May 2019

Research Appointments

Graduate Researcher

University of Georgia, Department of Physics & Astronomy

Advisor: Dr. Michael R. Geller

May 2021 – April 2026

Athens, Georgia

- Led doctoral research on digital quantum simulation of open and noisy quantum systems, including non-Hermitian Hamiltonians, nonlinear quantum maps, reservoir-engineered dynamics, and finite-memory transmission-line models.
- Developed gate-level models of explicit qubit links for squeezed bosonic transmission lines, enabling comparison between reduced Lindblad predictions and transport-resolved observables such as concurrence, local populations, recollision dynamics, and transmission-line occupation.
- Designed hardware-aware quantum circuits for effective non-Hermitian evolution and engineered dissipative dynamics on IBM quantum processors.
- Built and analyzed noise models including amplitude damping, dephasing, Pauli-twirled transport noise, and surface-code-inspired logical process diagnostics.
- Applied tensor-network and matrix-product-state compression methods to reduce deep target circuits into shallower hardware-amenable ansatz circuits while preserving physically relevant observables.
- Developed machine-learning and variational methods for simulation and parameter reconstruction in non-Hermitian and open-system dynamics.

Ph.D. Intern – Quantum Computing

Pacific Northwest National Laboratory

Mentor: Dr. Ang Li

August 2024 – May 2025

Richland, Washington

- Designed a unified spatiotemporal distributed quantum sensing architecture connecting quantum sensing, storage, communication, and processing.
- Simulated wave-like dark matter detection and satellite-based quantum radar using distributed quantum sensing and quantum networking techniques.
- Implemented and validated quantum-networking and sensing protocols on IonQ and IBM quantum devices.

- Developed noise models to evaluate experimental device geometries and quantify the effect of hardware imperfections on sensing performance.
- Published this work in *ACM Transactions on Quantum Computing*.

Undergraduate Researcher

January 2018 – May 2019

University of Georgia, Department of Physics & Astronomy

Athens, Georgia

Advisors: Dr. Philip Stancil and Dr. Steven Lewis

- Simulated condensed-matter and molecular interactions using LAMMPS for applications in laboratory astrophysics and interstellar-medium chemistry.
- Modeled hydrogen collisions with amorphous ice using Lennard-Jones potentials and analyzed molecular-dynamics data with Python to estimate sticking coefficients.

Publications

1. **A. Jebraeilli** et al., *Quantum simulation of a qubit with non-Hermitian Hamiltonian*, *Physical Review A*, accepted 2025.
2. **A. Jebraeilli** et al., *STQS: A Unified System Architecture for Spatial Temporal Quantum Sensing*, *ACM Transactions on Quantum Computing*, 2025.

Manuscripts in Preparation

1. **A. Jebraeilli** et al., *Digital simulation of squeezed bosonic transmission lines with explicit qubit links*, manuscript in preparation.
2. **A. Jebraeilli** et al., *Noise-aware quantum sensing for wave-like dark matter detection with superconducting qubits*, manuscript in preparation.
3. **A. Jebraeilli** et al., *Digital simulation of non-completely-positive quantum channels*, manuscript in preparation.

Selected Presentations

SPAGSS Symposium

April 2026

Invited Speaker

Auburn, Alabama

Invited 25-minute presentation with Q&A on quantum simulation, quantum sensing, and open-system dynamics.

American Physical Society March Meeting

March 2026

Talk

Denver, Colorado

“STQS: A Unified System Architecture for Spatial Temporal Quantum Sensing.”

University of Manchester

February 2026

Invited Talk, QTFP Forum

Manchester, United Kingdom

“Quantum Gate Simulation of a Qubit with a Non-Hermitian Hamiltonian.”

Pacific Northwest National Laboratory

February 2025

Computational Science Facility Seminar

Richland, Washington

Lab-wide presentation on the STQS architecture and its applications to distributed quantum sensing.

American Physical Society March Meeting

March 2024

Talk

Minneapolis, Minnesota

“Harnessing Non-Hermitian Hamiltonians: Advancements in NISQ-era Superconducting Qubit Technologies.”

Conference for Graduate Women & Gender Minorities in Physics

August 2024

Attendee

Washington, DC

CURO Symposium

Presenter

Presented molecular-dynamics simulations of hydrogen collisions with amorphous ice.

April 2019

Athens, Georgia

Awards and Grants

Franklin College Research Assistantship

QuaNTRASE

2024

2022–2023

Teaching, Mentoring, and Service

Teaching Assistant

University of Georgia, Department of Physics & Astronomy

August 2019 – April 2026

Athens, Georgia

- Taught undergraduate physics laboratories, supported conceptual problem solving, and prepared students for exams and lab assessments.
- Mentored younger graduate students and students entering quantum computing through guidance on simulation workflows, Qiskit, scientific programming, and research writing.

Academic and Standardized Testing Tutor

Five Points Prep

Tutored SAT, ACT, GRE, AP exams, and high-school and undergraduate STEM coursework.

April 2024 – August 2024

Athens, Georgia

Tutor

Rankin M. Smith Student-Athlete Academic Center

Supported 30–40 students in university physics, astronomy, and mathematics courses.

May 2017 – May 2019

Athens, Georgia

Graduate Student Service

University of Georgia

Served on graduate-student panels and contributed to discussions of graduate-student needs, departmental climate, and student support. Led and participated in informal information sessions for graduate-student workplace advocacy and community building.

2021 – 2026

Athens, Georgia

Science Communication and Public Outreach

- *New Wave Function: Quantum circuit sonification tool*. Developed an interactive web-based outreach project that maps quantum-circuit structure to musical notes and sound, using analogies between quantum registers, gates, rotations, and musical scales to make quantum computing more approachable for students and the public.
- “Quantum Computing 2.0: How A UGA Physicist Builds On A Century Of Knowledge To Research The Impossible.” Featured in a public-facing article on quantum computing research at the University of Georgia.

Technical Skills

Programming

Python, Julia, Bash, HTML/CSS, JavaScript, QASM 2.0/3.0, Git/GitHub

Quantum software

Qiskit, Qiskit Aer, qiskit-ibm-runtime, IBM Quantum, IonQ, Stim, PennyLane, Mathematica/Wolfram QuantumFramework

Simulation methods

Open-system dynamics, non-Hermitian Hamiltonians, Lindblad models, noisy circuit simulation, process tomography, surface-code simulations, quantum Fisher information, tensor-network/MPS compression

Scientific tools

HPC systems, NumPy/SciPy, Matplotlib, LaTeX, Overleaf, Excel, LAMMPS, Moltemplate, VMD

Languages

English, Mandarin Chinese