Dr. Kaitlin M. Gili

Website | Email | LinkedIn

EDUCATION:

University of Oxford, Oxford, England — Received April 2024
PhD in Physics
Research Thesis: Quantum Generative Machine Learning Methods
Advisors: Dr. Chris Ballance & Prof. David Lucas

Stevens Institute of Technology, Hoboken, NJ — Received May 2020
Bachelor of Science in Physics
GPA: 3.94/4.0; **Achievements:** Pinnacle Scholar, Dean's List, Presidential Scholarship
Leadership: Society of Physics Students President, Physics Dept. Student Chair, Peer Mentor & Orientation Leader, Global Ambassador.

SKILLS:

Main Technical Areas: Classical and quantum machine learning methods (language encoding and classification; generative modeling for dynamical simulation). Modeling students' learning (i.e. sensemaking) in STEM education.
Research Ethics: Social & Behavioral CITI Program certified.
Software: Python, Java, Qiskit, PennyLane, PyTorch, Cirq, Orquestra, Tensor Flow, Tensor Flow Quantum, GitHub, Conda, Jupyter, LaTeX.
Leadership: Project management, relationship building, agile decision-making, and clear communication.
Languages: Fluent in English, Beginner in Spanish.

PUBLICATIONS & MANUSCRIPTS:

Gili, K., Heuton, Kyle., Shah, Astha., Hughes, MC. Using machine learning to measure evidence of students' sensemaking in physics courses. 2025. Preprint available at arXiv: 2503.15638 . Submitted to PRPER.

Wojnowicz M., **Gili K.**, Rath P., Miller E., Miller , Hancock C., O"Donovan M., Elkin-Frankston S., Brunye T., Hughes, MC. Discovering group dynamics in coordinated time series via hierarchical recurrent switching-state models. 2024. Preprint available at arXiv: 2401.14973. In review for TMLR.

Gili, K., Alonso, G., and Schuld, M. An inductive bias from quantum mechanics: learning order effects with non-commuting measurements. Quantum Mach. Intell. 6, 67 (2024). https://doi.org/10.1007/s42484-024-00200-0**.**

Gili, K., Hibat-Allah M., Marta M., Ballance, C., and Ortiz, Alejandro. "Do quantum circuit born machines generalize?". Quantum Sci. Technol. 8 035021 (2023). Preprint available at arXiv: 2207.13645**.**

Gili, K., Sveistrys, M., Ballance, C. "Introducing non-linear activations into quantum generative models" Phys. Rev. A 107, 012406 (2023). Preprint available at arXiv: 2205.14506**.**

Gili, K., Mauri, M., Perdomo-Ortiz, A. "Generalization metrics for practical quantum advantage in generative models". Phys. Rev. Applied **21**, 044032 (2024). Preprint available at arXiv: 2201.08770.

Gibbs, J., **Gili, K**., Holmes, Z. *et al.* "Long-time simulations for fixed input states on quantum hardware. *npj Quantum Inf* 8, 135 (2022). Preprint available at arXiv: 2102.04313**.**

Sarma, A., Chatterjee, R., **Gili, K.,** Yu, T. "Quantum unsupervised and supervised learning on superconducting **p**rocessors",Quantum Information and Computation, Vol. 20, No. 7&8 (2020) 541-552 Rinton Press. Preprint available at arXiv: 1909.04226.

Siddiqui, A. U., **Gili, K**., Ballance, C. (2024). Stressing out modern quantum hardware: Performance evaluation and execution insights. Preprint available at arXiv: 2401.13793.

Gili, K., Kumar, R., Sveistrys, M., Ballance, C. "A supplemental investigation of non-linearity in quantum generative models with respect to simulatability and optimization" (2023) Preprint available at arXiv: 2302.00788.

RESEARCH ROLES:

Full-Time Post-doctoral Researcher, CS Dept., Tufts University, MA, USA Jun 2024 - Present
Advisors: Prof. Mike Hughes

- Designing probabilistic methods to measure student learning (i.e. sensemaking) with real-time data from STEM classrooms.
- Modeling the dynamics of student conversations to pinpoint evidence of sensemaking; modeling the dynamics of the in-moment sensemaking process; modeling the impact of using ML tools for learning interventions.
- Understanding correlations and causation between sensemaking and other measurable outcomes of educational instruction.

Full-Time PhD Graduate Researcher, Physics Dept., University of Oxford, UK Jan 2021 - Apr 2024
Do Quantum Models Make Good Generative Learners? | Advisors: Dr. Chris Ballance & Dr. David Lucas | Ext. Collaborators: Zapata Computing; Microsoft Azure; Xanadu Inc.

- Led and collaborated on research projects that push the capabilities of quantum circuits as generative ML models.
- Focused on quantum model design, algorithm evaluation techniques, NISQ hardware implementations, and using structures from quantum foundations and information theory to determine practical algorithm understanding & utility.

QML Research Intern, Xanadu Technologies**,** Toronto, Canada Jan 2023 - May 2023
Advisor: Dr. Maria Schuld

- Co-led a research project that uses a novel design for a multi-task quantum generative model to learn the non-commutative structure in a human cognition dataset of order effects.
- Implemented and gathered results in PennyLane to demonstrate the model's ability to learn cognitive questions as quantum observables and generalize to new order effect datasets.

Quantum Applications Intern, Zapata Computing, MA, USA Oct 2020 - Jan 2021
Advisor: Alejandro Perdomo Ortiz

- Contributed to the software Orquestra toolkit by implementing gradient methods for a novel meta-learning algorithm, such that one can train larger quantum machine learning models more efficiently.
- Evaluated various optimization methods for quantum generative models in order to assess training resources and performance.

QC Summer Fellow, Los Alamos National Laboratory, NM, USA Jun 2020 – Oct 2020
Advisors: Dr. Andrew Sornborger, Dr. Zoe Holmes, & Dr. Patrick Coles

- Collaborated with a team to develop a variational quantum algorithm called Fixed State Variational Fast-Forwarding (FSVFF) that allows for dynamical systems to be simulated on quantum hardware beyond the coherence time with fewer quantum resources than previous methods.
- Implemented the algorithm on various quantum hardware devices for a robust performance assessment.

QC Undergrad Researcher, Stevens Institute of Technology, NJ, USA Dec 2018 – Aug 2019
Advisor: Dr. Rupak Chatterjee

- Implemented an algorithm for Quantum K-Means Clustering by amplitude encoding classical data into quantum states and utilizing quantum kernel methods.
- Demonstrated simulation results on IBM's quantum processor for practical datasets, showcasing both an accuracy and efficiency improvement than classical methods.

Nakatani RIES Fellow, Keio University, Japan & Rice University, TX May 2018 – Aug 2018
An Algorithm for Quantum Finite Automata | Advisors: Kohei Itoh, Dr. Rodney Van, Dr. Rudy Raymond

- Designed and implemented an algorithm for Quantum Finite Automata (QFA) that requires exponentially fewer qubits than classical bits, providing a complexity speed-up.
- Published an IBM qiskit tutorial page to help new quantum programmers understand the algorithm and quantum computing basics.

LEADERSHIP ROLES:

Undergraduate Student Research Advisor & Mentor, Oxford/Tufts/Remote 2021 - Present

- Develops projects for undergraduate students , secures funding, and advises the students toward project completion. Provides mentorship, technical lectures, and professional development discussions for students entering graduate programs or industry.
- Previously advised 4 students - each project resulting in a research manuscript for publication; 3/4 students already graduated and obtained admission to a quality PhD program.

Encouraging Women Across All Borders (EWAAB) Jun 2021 - Present
Board Chair and Co-Founder of U.S. 501c3 Nonprofit ewaab.org

- Works closely with the full-time employed CEO in order to develop and meet strategic goals for the organization; including fundraising, programming, and operations.
- Ensures the effectiveness of the Board of Trustees; including Board member recruitment, organizing quarterly meetings, supporting committee heads, and leading task forces based on the needs of the organization.

Head of Compensation Task Force Jun 2021 - Jul 2021

- Led a special task force of Board Members to formally hire, on-board, and develop on-going evaluation metrics for a full-time Chief Executive Officer. Directed Compensation Task Force meetings and directed all formal negotiations with the incoming CEO.

Chief Executive Officer and Co-Founder Jun 2019 - Jun 2021

- Co-founded a nonprofit that operates programs for hundreds of women/non-binary students across 5 countries. Directed strategic development, program design and implementation, marketing and networking, and providing quarterly updates on impact and fundraising KPIs to the Board of Trustees.
- Personally raised over $80k for the organization, recruited 8 additional professional board members, and coordinated strategic partnerships with top companies such as GoldenTree Asset Management and PIMCO.

Stevens Institute of Technology Board of Trustees Jun 2020 – Jun 2023
Elected Young Alumni Trustee – 3 Year Term

- Manages and governs the university along with Charter and Alumni Trustees on the Board through participating in quarterly Board meetings and annual strategic summits.
- Provides direction and delivers presentations to the Board regarding the improvement of student experience, alumni engagement, and diversity targets.

STEM ED. OUTREACH:

Pathfinders Program, Boston Partners in Education, Boston MA Sept. 2024 - Present
Deliver intermittent in-person presentations to K-12 schools in the greater Boston area to share my journey on becoming and being a scientist.

APS 2025 Conf. for Undergraduate Gender Minorities, Stevens Institute of Tech. Jan 2024 - Present
Member of the organizing committee for the Jan 2025 conference.

ADAPT Program Alumni Mentor, Stevens Institute of Tech. Sept 2024 - Present
Mentor a group of Freshman students coming from low-income families.
Participate in panels, lead workshops, and be an active resource for students.

Iteration One Outreach Project, MA & FL USA Sept 2022 - Sept 2024
Deliver in-person presentations to 10-20 high school science classes on quantum physics and machine learning topics in order to spark curiosity in students with traditionally less access.

Quantum Cognition & ML Series, Stevens Institute of Tech. April 2023
Teach an invited 4-part lecture series to faculty and students.

Oxford High School Physics Day, In-Person Speaker Jun 2022
Invited speaker to discuss life as a quantum researcher.

Marie Curious Physics Day, Workshop Leader — May 2022
Volunteered to lead middle school girls through physics workshops.

Qubit X Qubit High School Program, Virtual Speaker — Dec 2021
Invited speaker to discuss life as a quantum researcher.

A Game for Young Students Learning Quantum Computing, Quantum Frontiers — Nov 2019
Blog Writer/Contributor for an article explaining an outreach tool for quantum computing known as Bas|KET>ball.

Quantum Information High (QIHigh), Stevens Institute of Tech. — Aug 2019-May 2020
Program Founder/ Instructor for quantum information topics for high school students.

Girls Who Code, Hoboken Charter School, NJ — Sept 2016 –Dec 2019
Local Instructor for the National GWC Program for Python and the basics of quantum computing.

FELLOWSHIPS & AWARDS:

G-Research Monthly Research Grant Award — Oct 2024
Awarded 2,000 pounds for research grant application

QC Graduate Research Fellowship, U.S. ARO — Jan 2021- Jan 2024
Fully funded 3-year PhD Fellowship; worth $247k

Unitary Fund MicroGrant — Sept. 2022
Awarded $4,000 for outreach grant application with Iteration One project

G-Research Monthly Research Grant Award — Jun 2022
Awarded 2,000 pounds for research grant application

G-Research Women in Quant Program — Aug 2021 - Aug 2022
Multiple fully funded 2-day professional development programs; 1 of 20 students selected

Community Bursary Award, St. Cross College, University of Oxford — Jun 2020
Awarded 5,000 pounds for community outreach excellence

QC Summer School Fellowship, Los Alamos National Laboratory — Jun 2020 – Aug 2020
Fully funded three-month internship, 1 of 18 students selected

Woman of Distinction Award, Stevens Institute of Technology — May 2020
Awarded for acting as an outstanding peer role model to other university women

Physics Leadership Award, Stevens Institute of Technology — May 2020
Awarded $500 for leader of the year within the Stevens Physics Department

Quantum Ideas Lab Competition, Stevens Institute of Technology — Mar 2019
Awarded $500 team award for research proposal, 1 of 6 selected

Conf. for Undergrad Women in Physical Sciences, University of Nebraska-Lincoln — Nov 2019
Invited speaker with an awarded travel and accommodation stipend, 1 of 12 selected

Gulf Coast Undergraduate Research Symposium (GCURS), Rice University — Nov 2019
Awarded travel and accommodation stipend for symposium, 1 of 11 selected

Undergrad School for Experimental QIP, University of Waterloo, Canada — May 2019 – Jun 2019
Awarded travel and accommodation stipend for program, 1 of 25 selected out of over 350 applicants

American Physical Society (APS) March Meeting, Boston — Mar 2019
Awarded Best Undergraduate Presentation in Session

Women in Physics FUTURE Program, California Institute of Technology — Nov 2018
Awarded travel and accommodation stipend for program, 1 of 30 selected out of over 250 applicants

Gulf Coast Undergraduate Research Symposium (GCURS), Rice University — Oct 2018
Awarded travel and accommodation stipend for symposium, 1 of 20 selected

Nakatani RIES Fellowship, Keio University, Japan — May 2018 – Aug 2018
Fully funded three-month research program, 1 of 12 selected out of 200 applicants

Katholieke Universiteit (KU) Leuven Int. Internship Program, Belgium — May 2017 – Aug 2017
Awarded travel and accommodation stipend for research, 1of 3 selected out of over 50 applicants

CONTRIBUTED TALKS:

Stevens IT Women's Gala — Mar 2025
Invited alumni and gala speaker.

Boston University Brain, Behavior, & Cognition Colloquium — Oct 2024
Invited colloquium speaker.

Tufts University Quantum Seminar, Invited Speaker — Apr 2024
Invited seminar speaker.

IWD Event Stevens Institute of Tech., Invited Speaker — Mar 2024
Invited panel speaker.

University of Colorado Boulder., Invited Speaker — Feb 2024
Invited seminar speaker.

AArete Technologies, Invited Speaker — Nov 2023
Invited company speaker.

Boeing Mathematical Seminar, Invited Speaker — Aug 2023
Invited seminar speaker.

Colorado School of Mines, Invited Speaker — April 2023
Invited seminar speaker.

Stevens IT Admitted Students Day, Invited Speaker — April 2023
Invited alumni speaker.

APS March Meeting, Las Vegas — Mar 2023
Invited session speaker for Quantum Generative Modeling

APS March Meeting, Las Vegas — Mar 2023
Speaker abstract accepted. Undergraduate advisee speaker abstract accepted.

QAISG NUS Singapore Seminar Group, Virtual — Mar 2023
Invited virtual speaker.

Quantum Technologies and Machine Learning (QTML), Naples, Italy — Nov 2022
Accepted poster presentation. Undergraduate advisee accepted talk and 2 undergraduate advisees accepted research posters.

Army Research Office Annual Grant Meeting, CO — Aug 2022
Research update presenter.

APS March Meeting, Chicago — Mar 2022
Speaker abstract accepted.

Women in Quantum Conference, Virtual — Mar 2021
Invited keynote speaker for Debunking Myths in Quantum Machine Learning

GoldenTree Asset Management, Building the Pipeline Panel Event — Dec 2020
Invited Panelist to speak on building the pipeline for women in STEM/Finance.

Open Data Science Conference (ODSC), Virtual — Oct 2020
Invited workshop speaker with Luis Serrano for an Introduction to Quantum Generative Modeling for classical ML experts

Mentorship Through the Ages Virtual Salon, CTE Foundation, Sonoma County — Jun 2020
Invited Panelist to speak on the importance of mentorship in young women's lives.

Conf. for Undergrad Women in Physical Sciences, University of Nebraska-Lincoln — Nov 2019

Invited speaker for how we can use Quantum Computers for Machine Learning

APS March Meeting, Boston — Mar 2019
Speaker abstract accepted.

Gulf Coast Undergraduate Research Symposium (GCURS), Rice University — Oct 2018
Speaker abstract accepted.

Small Curly Institute (SCI) Summer Research Colloquium, Rice University — Aug 2018
Poster presentation accepted.

VALUES: Honesty, Curiosity, Growth, Freedom, and Challenge.