Anthony Polloreno, Ph.D. Candidate

Quantum information scientist interested in quantum computation, metrology, characterization and error correction. Bias for experimental collaboration and engagement through software.

gmail, github, twitter: ampolloreno

Education

Aug 2019 - May 2023	Ph.D., Physics University of Colorado, Boulder	GPA: 3.875
Aug 2019 - May 2022	M.S., Physics University of Colorado, Boulder	GPA: 3.875
Aug 2012 - May 2016	B.A., Computer Science, Physics, and Pure Mathematics University of California, Berkeley	GPA: 3.76

Awards and Scholarships

April 2021	NASA Space Technology Graduate Research Opportunity (NSTGRO) Fellowship
February 2021	QISE-NET Award (Cohort 4)
Dec 2019	C.U. Boulder Domestic Graduate Travel Grant
March 2016	C.U. Boulder Graduate Dean's Fellowship (Awarded)
Dec 2014	Pomerantz Physics Scholarship
Aug 2012	U.C. Berkeley Regents' and Chancellor's Scholarship

Patents

1. Michael Justin Gerchick Scheer, Maxwell Benjamin Block, Benjamin Jacob Bloom, Matthew J Reagor, Alexander Papageorge, Kamal Yadav, Nasser Alidoust, Colm Andrew Ryan, Shane Arthur Caldwell, Yuvraj Mohan, **Polloreno, Anthony**, John Morrison Macaulay, and Blake Robert Johnson. Modular quantum processor architectures, November 4 2021. US Patent App. 17/119,089
2. Alexander Papageorge, Benjamin Jacob Bloom, **Polloreno, Anthony**, Sabrina Sae Byul Hong, and Nasser Alidoust. Operating a quantum processor having a three-dimensional device topology. Library Catalog: Google Patents

Programming Languages and Frameworks

Languages: Python, Mathematica, Julia, Common Lisp, Java, C++, SQL, LaTeX, [Quil⟩

Frameworks & Tools: MPI, Docker, Postgres, AWS, SQLAlchemy, Atlassian, Slurm

Work Experience

April 2019 - December 2019	Software Engineer at Ψ-inf Software engineering consultant. Built infrastructure for scientific computing companies. Developed tools for storing, structuring and retrieving data from various experiments (SQLAlchemy).
June 2016 - August 2019	Quantum Engineer at Rigetti Quantum Computing Calibrated and characterized superconducting quantum computers ($\leq$ 32 qubits). Developed, tested and simulated efficient routines for device bring-up and characterization (Julia). Maintained and developed the software suite for experiments, including APIs for easily accessing and using calibrated pulses and pulse sequences (Python). Developed instrument drivers and signal processing routines, e.g. matched filtering of RF signals (C++). Built functionality for the compiler and simulator, implemented randomized benchmarking and provided APIs to access them (Lisp). Developed customer facing code to access the quantum computer (pyQuil), including implementing standard algorithms (Grove).

Research Experience

May 2021 - Present	Graduate Student Intern at Sandia National Laboratories *Quantum Error Correction* Research with Robin Blume-Kohout, Kevin Young and Timothy Proctor to identify physical quantities that are predictive of error corrected performance. Working at the interface of quantum error correction and quantum characterization. Work funded by Sandia and QISE-NET grant.
Aug 2019 - May 2023	Graduate Student at JILA and University of Colorado, Boulder *Thesis Title: Characterizing Quantum Devices Using the Principles of Quantum Information* Graduate student in the Smith group, focusing on quantum metrology, computation, information, error correction and characterization.
September 2018 - October 2018	Visiting Researcher at UT Austin *Random Quantum Circuits* Researching properties of random quantum circuits with Scott Aaronson. In particular, trying to prove that the probabilities for measuring different computational basis vectors following a random circuit are Porter-Thomas distributed.
June 2015 - January 2016	Student Intern at Sandia National Laboratories *Quantum Computation and Control* Worked with Kevin Young to develop techniques for using quantum optimal control to average away coherent error using gradient-based methods (GRAPE) and optimization.
July 2013 - July 2015	Student Assistant at Lawrence Berkeley National Laboratory *Beamline Optics, Reflection Zone Plates* Worked with Dmitriy Voronov to develop elliptical grating patterns called reflection zone plates which allow for more efficient beamline signal transmission in the Advanced Light Source. Used Python to generate patterns for the gratings as .cif files for use by electron beam and laser lithography machines.
January 2013 - May 2013	Undergraduate Research Apprenticeship at U.C. Berkeley *Animal Flight Laboratory, Hummingbird Flight* Worked with graduate student Marc Badger to investigate how hummingbirds navigate natural vegetation. Learned about avian flight as well as animal handling, and was introduced to basic experimentation techniques, Arduino usage, and Mathematica.

Publications

1. **Polloreno, Anthony M** and Graeme Smith. The qaoa with slow measurements. *arXiv preprint arXiv:2205.06845*, 2022
2. **Anthony M. Polloreno**, Ana Maria Rey, and John J. Bollinger. Individual qubit addressing of rotating ion crystals in a penning trap. *Physical Review Research*, 4(3), July 2022
3. **Polloreno, Anthony M**, Jacob L Beckey, Joshua Levin, Ariel Shlosberg, James K Thompson, Michael Foss-Feig, David Hayes, and Graeme Smith. Opportunities and limitations in broadband sensing. *arXiv preprint arXiv:2203.05520*, 2022
4. **Polloreno, Anthony M** and Kevin Young. Robustly decorrelating errors with mixed quantum gates. *Quantum Science and Technology*, 2021
5. Sabrina S. Hong, Alexander T. Papageorge, Prasahnt Sivarajah, Genya Crossman, Nicolas Didier, **Anthony M. Polloreno**, Eyob A. Sete, Stefan W. Turkowski, Marcus P. da Silva, and Blake R. Johnson. Demonstration of a parametrically activated entangling gate protected from flux noise. *Physical Review A*, 101(1), January 2020
6. C. M. Wilson, J. S. Otterbach, N. Tezak, R. S. Smith, **A. M. Polloreno**, Peter J. Karalekas, S. Heidel, M. Sohaib Alam, G. E. Crooks, and M. P. da Silva. Quantum kitchen sinks: An algorithm for machine learning on near-term quantum computers, 2018

7. S. A. Caldwell, N. Didier, C. A. Ryan, E. A. Sete, A. Hudson, P. Karalekas, R. Manenti, M. P. da Silva, R. Sinclair, E. Acala, N. Alidoust, J. Angeles, A. Bestwick, M. Block, B. Bloom, A. Bradley, C. Bui, L. Capelluto, R. Chilcott, J. Cordova, G. Crossman, M. Curtis, S. Deshpande, T. El Bouayadi, D. Girshovich, S. Hong, K. Kuang, M. Lenihan, T. Manning, A. Marchenkov, J. Marshall, R. Maydra, Y. Mohan, W. O'Brien, C. Osborn, J. Otterbach, A. Papageorge, J.-P. Paquette, M. Pelstring, **A. Polloreno**, G. Prawiroatmodjo, V. Rawat, M. Reagor, R. Renzas, N. Rubin, D. Russell, M. Rust, D. Scarabelli, M. Scheer, M. Selvanayagam, R. Smith, A. Staley, M. Suska, N. Tezak, D. C. Thompson, T.-W. To, M. Vahidpour, N. Vodrahalli, T. Whyland, K. Yadav, W. Zeng, and C. Rigetti. Parametrically activated entangling gates using transmon qubits. *Physical Review Applied*, 10(3), September 2018

8. Matthew Reagor, Christopher B. Osborn, Nikolas Tezak, Alexa Staley, Guenevere Prawiroatmodjo, Michael Scheer, Nasser Alidoust, Eyob A. Sete, Nicolas Didier, Marcus P. da Silva, Ezer Acala, Joel Angeles, Andrew Bestwick, Maxwell Block, Benjamin Bloom, Adam Bradley, Catvu Bui, Shane Caldwell, Lauren Capelluto, Rick Chilcott, Jeff Cordova, Genya Crossman, Michael Curtis, Saniya Deshpande, Tristan El Bouayadi, Daniel Girshovich, Sabrina Hong, Alex Hudson, Peter Karalekas, Kat Kuang, Michael Lenihan, Riccardo Manenti, Thomas Manning, Jayss Marshall, Yuvraj Mohan, William O'Brien, Johannes Otterbach, Alexander Papageorge, Jean-Philip Paquette, Michael Pelstring, **Anthony Polloreno**, Vijay Rawat, Colm A. Ryan, Russ Renzas, Nick Rubin, Damon Russel, Michael Rust, Diego Scarabelli, Michael Selvanayagam, Rodney Sinclair, Robert Smith, Mark Suska, Ting-Wai To, Mehrnoosh Vahidpour, Nagesh Vodrahalli, Tyler Whyland, Kamal Yadav, William Zeng, and Chad T. Rigetti. Demonstration of universal parametric entangling gates on a multi-qubit lattice. *Science Advances*, 4(2):eaao3603, February 2018

Talks/Posters

1. **Polloreno, Anthony**, Jacob Beckey, Joshua Levin, Ariel Shlosberg, James Thompson, Michael Foss-Feig, David Hayes, and Graeme Smith. No free quantum fisher information: Limitations and opportunities in broadband signal estimation. *TQC*, 2022

2. **Polloreno, Anthony**, Jacob Beckey, Joshua Levin, Ariel Shlosberg, James Thompson, Michael Foss-Feig, David Hayes, and Graeme Smith. No free quantum fisher information: Limitations and opportunities in broadband signal estimation. *QuSoft Seminar*, 2022

3. **Polloreno, Anthony M**, Ana Maria Rey, and John J Bollinger. Individual qubit addressing of rotating ion crystals in a penning trap. *Bulletin of the American Physical Society*, 2022

4. **Polloreno, Anthony**, Jacob Beckey, Joshua Levin, Ariel Shlosberg, James Thompson, Michael Foss-Feig, David Hayes, and Graeme Smith. No free quantum fisher information: Limitations and opportunities in broadband signal estimation. *Bulletin of the American Physical Society*, 2022

5. **Anthony Polloreno** and Kevin Young. Robustly decorrelating errors with mixed quantum gates. Southwest Quantum Information and Technology (SQuInT), 2020

6. **Polloreno, Anthony**. Robust decorrelation of errors in quantum gates by random gate synthesis. *Bulletin of the American Physical Society*, 2019

7. **Anthony Polloreno**, Nicholas Rubin, Robert Smith, and William Zeng. Random quantum circuits with varying topologies and gate sets. Southwest Quantum Information and Technology (SQuInT), 2017

8. **Anthony Polloreno**, Nicholas Rubin, Robert Smith, and William Zeng. Random quantum circuits with varying topologies and gate sets. APS March Meeting, 2017

Teaching Experience

January 2020 - June 2020

Grader for Physics 4230 at C.U. Boulder

Graded homework and quizzes for upper division, thermodynamics and statistical mechanics with Oliver DeWolfe.

January 2020 - June 2020

Teaching Assistant for Physics 2020 C.U. Boulder

Taught two sections of introductory experimental physics for non-majors. Course taught by Colin West.

August 2019 - December 2019

Teaching Assistant for Physics 1110 and 1115 at C.U. Boulder

Taught three sections of introductory general physics, one for majors. Led tutorial sections introducing students to ideas in kinematics and dynamics and graded homework. Course taught by Daniel Bolton, Cindy Regal, and Shijie Zhong.

August 2019 - December 2019

Grader for Physics 4410 at C.U. Boulder

Graded homework and quizzes for upper division, second-semester quantum mechanics with Andreas Becker.

June 2014 - August 2014

Undergraduate Student Instructor for CS70 at U.C. Berkeley

Worked as an undergraduate student instructor under James Cook for the summer offering of a course in discrete mathematics and probability in the Computer Science department. Taught a discussion section of 10 students twice a week, held office hours, wrote homework and exam problems, and ran review sessions.

January 2014 - May 2014

Reader for CS61A at U.C. Berkeley

Graded homework, tests, and projects and held office hours for the introductory Computer Science course, taught by Paul Hilfinger.