Andrew Zhao

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Education

University of New Mexico, Albuquerque, NM, USA — Aug 2018 to May 2024
Department of Physics and Astronomy
Center for Quantum Information and Control

PhD, Physics (with distinction) — Defended Nov 2023
Advisor: Akimasa Miyake

Dissertation: *Learning, Optimizing, and Simulating Fermions with Quantum Computers*
Chairman's Award for Best Dissertation, 2024

MSc, Physics — Jul 2021

University of Maryland, College Park, College Park, MD, USA — Sep 2013 to May 2018
Department of Physics
University of Maryland Honors College, Gemstone Program

BSc, Physics

Experience

Postdoctoral Research Fellow, Sandia National Laboratories (Livermore, CA) — Feb 2024 to present
Gil Herrera Fellowship in Quantum Information Science
Quantum Algorithms and Applications Collaboratory

Student Researcher, Google (San Francisco, CA) — May 2022 to Dec 2022
Google Quantum AI
Host: Nicholas Rubin

Graduate Research Assistant, University of New Mexico (Albuquerque, NM) — Jan 2019 to Dec 2023
Department of Physics and Astronomy
Center for Quantum Information and Control
Advisor: Akimasa Miyake

Graduate Teaching Assistant, University of New Mexico (Albuquerque, NM) — Aug 2018 to May 2019
Department of Physics and Astronomy

Undergraduate Research Assistant, University of Maryland (College Park, MD) — Feb 2016 to May 2017
Joint Center for Quantum Information and Computer Science
Mentor: Shelby Kimmel

Grants

Gil Herrera Fellowship in Quantum Information Science — Mar 2024 to present
US $215,000
Project PI. Funded by the Laboratory Directed R&D program at Sandia National Laboratories (Computing & Information Sciences Division).

Publications

Peer-reviewed articles

- **A. Zhao**, "Learning the Structure of Any Hamiltonian from Minimal Assumptions," *Proceedings of the 57th Annual ACM Symposium on Theory of Computing (STOC)*, 1201, 2025.
- **A. Zhao**, N. C. Rubin, "Expanding the reach of quantum optimization with fermionic embeddings," *Quantum* **8**, 1451, 2024.
- **A. Zhao**, A. Miyake, "Group-theoretic error mitigation enabled by classical shadows and symmetries," *npj Quantum Information* **10**, 57, 2024.
- R. Babbush, W. J. Huggins, D. W. Berry, S. F. Ung, **A. Zhao**, D. R. Reichman, H. Neven, A. D. Baczewski, J. Lee, "Quantum simulation of exact electron dynamics can be more efficient than classical mean-field methods," *Nature Communications* **14**, 4058, 2023.
- A. K. Daniel, Y. Zhu, C. H. Alderete, V. Buchemmavari, A. M. Green, N. H. Nguyen, T. G. Thurtell, **A. Zhao**, N. M. Linke, A. Miyake, "Quantum computational advantage attested by nonlocal games with the cyclic cluster state," *Physical Review Research* **4**, 033068, 2022.

- **A. Zhao**, N. C. Rubin, A. Miyake, "Fermionic Partial Tomography via Classical Shadows," *Physical Review Letters* **127**, 110504, 2021.
- **A. Zhao**, A. Tranter, W. M. Kirby, S. F. Ung, A. Miyake, P. J. Love, "Measurement reduction in variational quantum algorithms," *Physical Review A* **101**, 062322, 2020.

Patents

- N. C. Rubin, **A. Zhao**, "Solving quadratic optimization problems over orthogonal groups using a quantum computer," US Patent US 2024 0296367 A1, 2024.

Talks

Invited

- "Hamiltonian learning: A survey of recent progress" — Mar 2025
  University of Sherbrooke Institut quantique Colloquium, *Sherbrooke, QC*
- "Group-theoretic error mitigation enabled by classical shadows and symmetries" — Nov 2023
  University of Oxford Quantum Technology Theory Seminar, *Virtual*
- "Quantum relaxation for quadratic programs over orthogonal matrices" — Oct 2023
  INFORMS Annual Meeting, *Phoenix, AZ*
- "Efficient and robust learning of quantum many-body properties with classical shadows" — Jun 2023
  Sandia Quantum Computer Science Seminar, *Virtual*
- "Efficient and robust learning of fermionic reduced density matrices with classical shadows" — Jan 2023
  UC Berkeley Quantum Many-body Seminar, *Virtual*

Contributed

- "Learning the structure of any Hamiltonian from minimal assumptions" — Jun 2025
  ACM STOC, *Prague, CZ*
- "Learning the structure of any Hamiltonian from minimal assumptions" — Mar 2025
  APS Global Physics Summit, *Anaheim, CA*
- "Learning the structure of any Hamiltonian from minimal assumptions" — Feb 2025
  QIP Conference, *Raleigh, NC*
- "Nearly Heisenberg-limited Hamiltonian learning with few assumptions" — Oct 2024
  SQuInT Workshop, *Broomfield, CO*
- "Group-theoretic error mitigation enabled by classical shadows and symmetries" — Oct 2023
  SQuInT Workshop, *Albuquerque, NM*
- "Calibration-free quantum error mitigation with classical shadows" — Mar 2023
  APS March Meeting, *Las Vegas, NV*
- "Fermionic partial tomography via classical shadows" — Mar 2021
  APS March Meeting, *Virtual*
- "Measurement reduction in variational quantum algorithms" — Mar 2020
  APS March Meeting, *Denver, CO* $\rightarrow$ *Virtual*

Teaching

Courses

- General Physics (PHYC 151), Graduate Supplemental Instructor — Spring 2019
  University of New Mexico, Department of Physics and Astronomy
- General Physics Laboratory (PHYC 151L), Graduate Lab Instructor — Fall 2018
  University of New Mexico, Department of Physics and Astronomy

Guest Lectures

- "Classical shadows are both simpler and more complicated than you think" — Mar 2025
  University of Sherbrooke Institut quantique seminar, *Sherbrooke, QC*
- "Quantum metrology and distributed quantum sensing" — Jun 2023
  UNM CQuIC Summer Course, *Albuquerque, NM*
- "Random unitary evolution, t-designs, and applications to quantum chaos" — Jun 2021
  UNM CQuIC Summer Course, *Virtual*
- "Continuous symmetries and $\mathrm{O}(N)$ models" — Jun 2020
  UNM CQuIC Summer Course, *Virtual*
- "Simple Lie groups and simple Lie algebras" — Jun 2019
  UNM CQuIC Summer Course, *Albuquerque, NM*

Advising

Sandia Graduate Interns

- Ramya Bhaskar, *University of Washington, PhD student* — Sep 2024 to present
- Aria Christensen, *Ohio State University, PhD student* — Aug 2024 to present

Professional Service

Journal Referee

Physical Review Letters • Physical Review A • Physical Review Research • PRX Quantum • Nature Communications • npj Quantum Information • Quantum • Communications in Mathematical Physics

Conference Referee

QIP • TQC • QSim • QCTIP

Grant Proposal Reviewer

Sandia LDRD program