

LEO ZHOU

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🔗 <https://leoxzhou.github.io/>

POSITIONS

University of California, Los Angeles <i>Assistant Professor, Department of Electrical and Computer Engineering</i>	<i>Los Angeles, CA</i> 2024–Present
BlueQubit, Inc. <i>Quantum R&D Scientist</i>	<i>Los Angeles, CA</i> 2023–Present
California Institute of Technology – Walter Burke Institute for Theoretical Physics <i>DuBridge Postdoctoral Scholar</i>	<i>Pasadena, CA</i> 2021–24

EDUCATION

Ph.D. in Physics, Harvard University <i>Advisor: Mikhail Lukin</i> Thesis: Complexity, Algorithms, and Applications of Programmable Quantum Many-Body Systems	<i>Cambridge, MA</i> 2014–21
B.Sc. in Physics and Mathematics, Massachusetts Institute of Technology <i>Advisor: Edward Farhi – Minor in Economics; GPA: 5.0/5.0</i> Thesis: Error-Suppression by Energy-Gap Protection for Quantum Computation in Open Systems	<i>Cambridge, MA</i> 2010–14

RESEARCH EXPERIENCE

Phasecraft, Ltd. <i>Visiting Fellow (Host: Ashley Montanaro)</i>	<i>Bristol, United Kingdom</i> 2024
Google Quantum AI <i>Research Intern (Host: Edward Farhi)</i>	<i>Venice, CA</i> 2019
Hebrew University – Department of Computer Science and Engineering <i>Visiting Researcher (Host: Dorit Aharonov)</i>	<i>Jerusalem, Israel</i> 2014 & 2015

AWARDS AND HONORS

• Outstanding Paper Award at the 17th Conference on Theory of Quantum Computation, Communication and Cryptography (TQC'22)	2022
• Winner (\$5k grant) of Excellent Contributed Talk at QC40: Physics of Computation Conference	2021
• Burke Prize Fellowship at the California Institute of Technology	2021
• Bloch Fellowship at Stanford University (declined)	2021
• Hartree Fellowship at the Institute of Advanced Computer Studies, University of Maryland (declined)	2021
• Martin & Beate Block Award (for best poster presented by co-author S.-T. Wang) at the Aspen Conference on Advances in Quantum Algorithms and Computation	2018
• National Science Foundation (NSF) Graduate Research Fellowship	2014–17
• Phi Beta Kappa (Academic Honor Society), MIT Xi Chapter	2014
• MIT Junior Lab Edward C. Pickering Award for Outstanding Original Project, Honorable Mention	2013

PUBLICATIONS

- I. Kannan, R. King, **L. Zhou**. *A Quantum Approximate Optimization Algorithm for Local Hamiltonian Problems*. Preprint on [arXiv:2412.09221](https://arxiv.org/abs/2412.09221), (2024).

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- A. Montanaro, **L. Zhou**[†]. *Quantum speedups in solving near-symmetric optimization problems by low-depth QAOA*. QIP'25 (2025). [arXiv:2411.04979](https://arxiv.org/abs/2411.04979).
- **L. Zhou**, J. Basso, S. Mei. *Statistical Estimation in the Spiked Tensor Model via the Quantum Approximate Optimization Algorithm*. In Proceedings of the 38th Annual Conference on Neural Information Processing NeurIPS'24 (2024). [arXiv:2402.19456](https://arxiv.org/abs/2402.19456).
- C.-F. Chen, H.-Y. Huang, J. Preskill, **L. Zhou**[†]. *Local minima in quantum systems*. In Proceedings of the 56th Symposium on Theory of Computing, STOC'24 (2024). Also appearing in Nature Physics (2025). [arXiv:2309.16596](https://arxiv.org/abs/2309.16596).
- J. Basso, D. Gamarnik, S. Mei, **L. Zhou**[†]. *Performance and limitations of the QAOA at constant levels on large sparse hypergraphs and spin glass models*. In Proceedings of the 63rd Symposium on Foundations of Computer Science, FOCS'22 (2022). [arXiv:2204.10306](https://arxiv.org/abs/2204.10306).
- S. Ebadi, ..., **L. Zhou**, ..., M.D. Lukin. *Quantum Optimization of Maximum Independent Set using Rydberg Atom Arrays*. Science 376, 1209 (2022). [arXiv:2202.09372](https://arxiv.org/abs/2202.09372).
- J. Basso, E. Farhi, K. Marwaha, B. Villalonga, **L. Zhou**[†]. *The Quantum Approximate Optimization Algorithm at High Depth for MaxCut on Large-Girth Regular Graphs and the Sherrington-Kirkpatrick Model*. In Proceedings of the 17th Conference on the Theory of Quantum Computation, Communication and Cryptography, TQC'22 (2022), Outstanding Paper Award. [arXiv:2110.14206](https://arxiv.org/abs/2110.14206).
- **L. Zhou**, D. Aharonov. *Strongly Universal Hamiltonian Simulators*. To appear in Nature Communications (2025). Also in QIP'21. [arXiv:2102.02991](https://arxiv.org/abs/2102.02991).
- M.P. Harrigan, ..., **L. Zhou**, ..., R. Babbush. *Quantum Approximate Optimization of Non-Planar Graph Problems on a Planar Superconducting Processor*. Nature Physics 17, 332 (2021). [arXiv:2004.04197](https://arxiv.org/abs/2004.04197).
- S.H. Cantu, A.V. Venkatramani, W. Xu, **L. Zhou**, B. Jelenković, M.D. Lukin, V. Vuletić. *Repulsive photons in a quantum nonlinear medium*. Nature Physics 16, 921 (2020). [arXiv:1911.02586](https://arxiv.org/abs/1911.02586).
- E. Farhi, J. Goldstone, S. Gutmann, **L. Zhou**[†]. *The Quantum Approximate Optimization Algorithm and the Sherrington-Kirkpatrick Model at Infinite Size*. Quantum 6, 759 (2022). Also in QIP'21. [arXiv:1910.08187](https://arxiv.org/abs/1910.08187).
- Z. Eldredge, **L. Zhou**, A. Bapat, J.R. Garrison, A. Deshpande, F.T. Chong, A.V. Gorshkov. *Entanglement bounds on the performance of quantum computing architectures*. Phys. Rev. Research 2, 033316 (2020). [arXiv:1908.04802](https://arxiv.org/abs/1908.04802).
- **L. Zhou**^{*}, S.-T. Wang^{*}, S. Choi, H. Pichler, and M.D. Lukin. *Quantum Approximate Optimization Algorithm: Performance, Mechanism, and Implementation on Near-Term Devices*. Phys. Rev. X 10, 021067 (2020). [arXiv:1812.01041](https://arxiv.org/abs/1812.01041).
- H. Pichler^{*}, S.-T. Wang^{*}, **L. Zhou**^{*}, S. Choi, and M.D. Lukin. *Computational complexity of the Rydberg blockade in two dimensions*. Preprint on [arXiv:1809.04954](https://arxiv.org/abs/1809.04954), (2018).
- H. Pichler^{*}, S.-T. Wang^{*}, **L. Zhou**, S. Choi, and M.D. Lukin. *Quantum Optimization for Maximum Independent Set Using Rydberg Atom Arrays*. Preprint on [arXiv:1808.10816](https://arxiv.org/abs/1808.10816), (2018).
- D. Aharonov and **L. Zhou**[†]. *Hamiltonian Sparsification and Gap-Simulation*. In Proceedings of the 2019 ACM Conference on Innovations in Theoretical Computer Science, ITCS'19 (2019). [arXiv:1804.11084](https://arxiv.org/abs/1804.11084).
- **L. Zhou**^{*}, S. Choi^{*}, and M.D. Lukin. *Symmetry-protected dissipative preparation of matrix product states*. Phys. Rev. A (2021). [arXiv:1706.01995](https://arxiv.org/abs/1706.01995).
- A.D. Bookatz, E. Farhi, and **L. Zhou**[†]. *Error suppression in Hamiltonian based quantum computation using energy penalties*. Phys. Rev. A 92, 022317 (2015). [arXiv:1407.1485](https://arxiv.org/abs/1407.1485).

- **L. Zhou** and G.S.F. Stephans. *Energy and centrality dependence of particle multiplicity in heavy ion collisions from $\sqrt{s_{NN}} = 20$ to 2760 GeV*. *Phys. Rev. C* 90, 0149902 (2014). [arXiv:1312.3656](https://arxiv.org/abs/1312.3656).
- N. Sinenian, ..., **L. Zhou**, ..., R.J. Leeper, *Upgrade of the MIT Linear Electrostatic Ion Accelerator (LEIA) for nuclear diagnostics development for Omega, Z and the NIF*. *Rev. Sci. Instrum.* **83**, 043502 (2012). [doi:10.1063/1.3703315](https://doi.org/10.1063/1.3703315).

* indicates equal contribution / co-first authorship

† indicates alphabetical ordering of authors

PRESENTATIONS

- *Quantum speedups in solving near-symmetric optimization problems by low-depth QAOA*
 - Accepted talk, 28th Annual Conference on Quantum Information Processing (QIP) 02.2025
 - Invited talk at the MIT Center for Theoretical Physics 11.2024
- *Statistical Estimation in the Spiked Tensor model via the QAOA*
 - Invited talk at Google Quantum AI 12.2024
 - Accepted talk, 38th Annual Conference on Neural Information Processing (NeurIPS) 12.2024
- *Local minima in quantum systems*
 - Invited talk at Oxford University 10.2024
 - Accepted talk, 56th ACM Symposium on Theory of Computing (STOC) [\[video\]](#) 06.2024
 - Invited talk at Institut de Recherche en Informatique Fondamentale (IRIF), Paris 05.2024
 - Accepted talk, 27th Annual Conference on Quantum Information Processing (QIP) [\[video\]](#) 01.2024
 - Invited talk at the Max Planck Institute of Quantum Optics 11.2023
- *Prospects of Variational Quantum Advantages in Optimization and Learning Problems*
 - Invited talk at the Phasecraft Quantum Algorithms Workshop 05.2024
- *Quantum Computational Advantages in Energy Minimization*
 - Invited talk at the Institute for Quantum Computing, University of Waterloo 04.2024
 - Invited talk at the University of Maryland, College Park 03.2024
 - Invited talk at the University of California, Los Angeles 03.2024
 - Invited talk at the University of Michigan 03.2024
 - Invited talk at Purdue University 02.2024
 - Invited talk at the Perimeter Institute for Theoretical Physics 02.2024
 - Invited talk at the C.N. Yang Institute for Theoretical Physics at Stony Brook University 02.2024
 - Invited colloquium at the University of Southern California 11.2023
 - Invited talk for the “Mathematical and Computational Challenges in Quantum Computing” program at the Institute for Pure and Applied Mathematics 11.2023
- *Performance and limitations of the QAOA at constant levels on large sparse hypergraphs and spin glass models*
 - Accepted talk, 18th Conference on Theory of Quantum Computation, Communication and Cryptography (TQC) [\[video\]](#) 07.2023
 - Accepted talk, 63rd Annual Symposium on Foundations of Computer Science (FOCS) 11.2022
- *Exploring Quantum Advantages in Optimization Problems*
 - Invited talk at the NISQ Algorithms and Hardware (NISQAH 2023) conference [\[video\]](#) 06.2023
- *Quantum computing with Rydberg atom arrays*
 - Tutorial talk at the 2023 APS March Meeting 03.2023
- *Advantages and Limitations of the Quantum Approximate Optimization Algorithm*
 - Invited talk at the 2023 Information: Theory and Applications (ITA) workshop 02.2023
 - Invited talks at the MIT Center for Theoretical Physics and QuEra Computing, Inc. 06.2022

- *The QAOA at High Depth for MaxCut on Large-Girth Regular Graphs and the SK Model*
 - Outstanding Paper Award talk at the 17th Conference on Theory of Quantum Computation, Communication and Cryptography (TQC) [[video](#)] 07.2022
- *Quantum Approximate Optimization: Challenges and Opportunities*
 - Invited talk at the 2021 INFORMS Annual Meeting 10.2021
- *Strongly Universal Hamiltonian Simulators*
 - Invited talk at the Simons Institute Quantum Wave in Computing Reunion Workshop 07.2021
 - Accepted talk at QC40: Physics of Computation Conference 40th Anniversary 05.2021
 - Invited talk at the QCDA (Quantum Code Design and Architecture) seminar 04.2021
 - Accepted talk, 24th Annual Conference on Quantum Information Processing (QIP) [[video](#)] 02.2021
- *The QAOA and the Sherrington-Kirkpatrick Model at Infinite Size*
 - Accepted talk, 24th Annual Conference on Quantum Information Processing (QIP) [[video](#)] 02.2021
- *Quantum Simulation and Optimization in Near-Term Quantum Computers*
 - Invited talk at the Stanford Q-FARM Special Seminar 12.2020
 - Invited talk at the MIT Center for Theoretical Physics 12.2020
 - Invited talk at the QM seminar, UC Berkeley [[video](#)] 12.2020
 - Invited talk at the Institute for Quantum Information (IQI) Seminar, Caltech 12.2020
- *Hamiltonian Sparsification and Gap-Simulation*
 - Accepted talk, 22nd Annual Conference on Quantum Information Processing (QIP) [[video](#)] 01.2019
 - Accepted talk, 10th Innovations in Theoretical Computer Science conference (ITCS) 01.2019
- *Quantum Approximate Optimization: Performance and Applications with MaxCut and Maximum Independent Set Problems*
 - Talk at the 50th Meeting of APS Division of Atomic, Molecular & Optical Physics 05.2019
 - Poster at the Quantum Science Gordon Research Conference 08.2018
 - Poster at the Aspen Conference on Advances in Quantum Algorithms and Computation 03.2018
- *Symmetry-protected dissipative preparation of matrix product state*
 - Invited talk at the Mathematical Picture Language Project Seminar, Harvard University 11.2019
 - Poster at the 48th Meeting of APS Division of Atomic, Molecular & Optical Physics 06.2017
 - Talk at the Quantum Science: Implementation workshop in Benasque, Spain 07.2016
- *Robust quantum information processing with atomic cat states*
 - Poster at the Atomic Physics Gordon Research Conference 06.2015

SERVICE AND OUTREACH

- Peer Reviewer for academic journals (Nature, Nature Communications, Physical Review, Quantum, ACM Transactions on Quantum Computing) and quantum computer science conferences (QIP, TQC, STOC, SODA) 2019–present
- Program committee for TQC'23 (18th conference on Theory of Quantum Computation) 2023
- Science talk for the MNTEC program at the Pasadena City College 2023
- MIT Society of Physics Students, Executive Council 2011–14
- Camp Mentor at MIT China Development Initiative's Service Leadership Program 2013
- Teaching high school students at Splash 2011 via the MIT Educational Studies Program 2011

TEACHING

- Instructor for *Physics of Quantum Information and Quantum Computation* (ECE 279AS) at University of California, Los Angeles 2025

- Lecturer for the “Rydberg Computers” tutorial at the 2023 APS March Meeting 2023
- Supporting Teaching Fellow for *Physics of Quantum Information* (Physics 271) and *Modern Atomic and Optical Physics II* (Physics 285b) at Harvard University 2016–20
- Teaching Fellow for *Electrodynamics* (Physics 153) at Harvard University 2018
- Visiting high school teacher in Gaildorf, Germany through MIT’s Global Teaching Lab 2012

MENTORING

- Sara Vanovac, graduate student at Caltech 2023–24
- Chi-Fang (Anthony) Chen, graduate student at Caltech 2022–24
- Ishaan Kannan, undergraduate student at Caltech 2021–24
- William (Robbie) King, graduate student at Caltech 2021–24
- Hsin-Yuan (Robert) Huang, graduate student at Caltech (now at Google, future Caltech faculty) 2021–23
- Joao Basso, undergraduate student at Tufts (now UC Berkeley graduate student) 2019–23
- Beatrice Nash, graduate student at Harvard 2020–21
- Katherine van Kirk, graduate student at Harvard 2020–21
- Madelyn Cain, graduate student at Harvard 2019–21
- Dylan Li, undergraduate student at Harvard Fall 2020
- Amir Shانهsazzadeh, undergraduate student at Harvard Fall 2020
- Abhishek Anand, undergraduate student at Harvard (now Caltech graduate student) 2018–19