

Ruizhe Zhang

CONTACT INFORMATION	Simons Institute for the Theory of Computing Melvin Calvin Laboratory #2190 Berkeley, CA 94720, USA	(512) 939-7564 ruizhe@utexas.edu https://www.ruizhezhang.com
RESEARCH INTERESTS	Theoretical computer science, quantum computing, and machine learning.	
EMPLOYMENT	University of California, Berkeley <i>Simons Quantum Postdoctoral Fellow</i> Host: Umesh Vazirani	Fall 2023 - present
EDUCATION	The University of Texas at Austin Ph.D. in Computer Science Thesis: <i>Quantum Meets Optimization and Machine Learning</i> Advisor: Dana Moshkovitz	August 2023
	Fudan University B.S. in Computer Science, <i>Honors Class</i>	May 2018
ACADEMIC EXPERIENCE	Institute for Pure & Applied Mathematics at UCLA Position: Departmental Scholar Core Participant of <i>Mathematical and Computational Challenges in Quantum Computing</i>	Fall 2023
	The University of Texas at Austin Position: Research Assistant Supervisors: Dana Moshkovitz, Scott Aaronson	Fall 2018 - Fall 2021
	Zapata Computing, Inc. Position: Quantum Research Intern Supervisors: Peter Johnson, Guoming Wang	Summer 2021, Summer 2022
HONORS AND AWARDS	University Graduate Continuing Fellowship, UT Austin Graduate School Fudan University First Prize Scholarship, Wonders Information The ACM-ICPC Asia Regional Contest Gold Medal, Shanghai Site The ACM-ICPC Asia Regional Contest Gold Medal, Hefei Site	
PUBLICATIONS	[1] Josh Alman, Jiehao Liang, Zhao Song, Ruizhe Zhang , Danyang Zhuo. Bypass exponential time preprocessing: Fast neural network training via weight-data correlation preprocessing. To appear at <i>the 37th Conference on Neural Information Processing Systems (NeurIPS)</i> , 2023. [2] Zhao Song, Baocheng Sun, Omri Weinstein, Ruizhe Zhang . Quartic Samples Suffice for Fourier Interpolation. To appear at <i>the 64rd Annual Symposium on Foundations of Computer Science (FOCS)</i> , 2023. [3] Ruizhe Zhang , Xinzhi Zhang. Hyperbolic Extension of Kadison-Singer Type Results. In <i>Proceedings of the 50th EATCS International Colloquium on Automata, Languages, and Programming (ICALP)</i> , 2023. [4] Guoming Wang, Daniel Stilck França, Ruizhe Zhang , Shuchen Zhu, Peter D. Johnson. Quantum algorithm for ground state energy estimation using circuit depth with exponentially	

improved dependence on precision. In *Quantum Computing Theory in Practice (QCTiP)*, 2023. (Contributed talk)

[5] Andrew Childs, Tongyang Li, Jin-Peng Liu, Chunhao Wang, **Ruizhe Zhang**. Quantum Algorithms for Sampling Log-Concave Distributions and Estimating Normalizing Constants. In *Proceedings of the 36th Conference on Neural Information Processing Systems (NeurIPS)*, 2022. In *26th Annual Conference on Quantum Information Processing (QIP)*, 2023. (Contributed talk)

[6] Tongyang Li, **Ruizhe Zhang**. Quantum Speedups of Optimizing Approximately Convex Functions with Applications to Logarithmic Regret Stochastic Convex Bandits. In *Proceedings of the 36th Conference on Neural Information Processing Systems (NeurIPS)*, 2022.

[7] Yichuan Deng, Zhao Song, Omri Weinstein, **Ruizhe Zhang**. Fast Distance Oracles for Any Symmetric Norm. In *Proceedings of the 36th Conference on Neural Information Processing Systems (NeurIPS)*, 2022.

[8] Baihe Huang, Shunhua Jiang, Zhao Song, Runzhou Tao, **Ruizhe Zhang**. Solving SDP Faster: A Robust IPM Framework and Efficient Implementation. In *Proceedings of the 63rd Annual Symposium on Foundations of Computer Science (FOCS)*, 2022.

[9] **Ruizhe Zhang**, Guoming Wang, Peter Johnson. Computing Ground State Properties with Early Fault-Tolerant Quantum Computers. In *Quantum, Volume 6, Number 761*, 2022.

[10] Jason Gaitonde, Max Hopkins, Tali Kaufman, Shachar Lovett, **Ruizhe Zhang**. Eigenstripping, Spectral Decay, and Edge-Expansion on Posets. In *Proceedings of the 26th International Conference on Randomization and Computation (RANDOM)*, 2022.

[11] Zhao Song, **Ruizhe Zhang**. Hyperbolic Concentration, Anti-concentration, and Discrepancy. In *Proceedings of the 26th International Conference on Randomization and Computation (RANDOM)*, 2022.

[12] Sitan Chen, Zhao Song, Runzhou Tao, **Ruizhe Zhang**. Symmetric Sparse Boolean Matrix Factorization and Applications. In *Proceedings of the 13th Innovations in Theoretical Computer Science Conference (ITCS)*, 2022.

[13] Nai-Hui Chia, Chi-Ning Chou, Jiayu Zhang, **Ruizhe Zhang**. Quantum Meets Minimum Circuit Size Problem. In *Proceedings of the 13th Innovations in Theoretical Computer Science Conference (ITCS)*, 2022.

[14] Zhao Song, Shuo Yang, **Ruizhe Zhang**. Does Preprocessing Help Training Over-Parameterized Neural Networks? In *Proceedings of the 35th Conference on Neural Information Processing Systems (NeurIPS)*, 2021.

[15] Yuxuan Zhang, **Ruizhe Zhang**, Andrew C. Potter. QED driven QAOA for network-flow optimization. In *Quantum, Volume 5, Number 510*, 2021.

[16] Scott Aaronson, Jiahui Liu, Qipeng Liu, Mark Zhandry, **Ruizhe Zhang**. New Approaches for Quantum Copy-Protection. In *Proceedings of the 41st Annual International Cryptology Conference (CRYPTO)*, 2021.

[17] Scott Aaronson, Nai-Hui Chia, Han-Hsuan Lin, Chunhao Wang, **Ruizhe Zhang**. On the Quantum Complexity of Closest Pair and Related Problems. In *Proceedings of the 35th Computational Complexity Conference (CCC)*, 2020.

[1] Yeqi Gao, Zhao Song, Xin Yang, **Ruizhe Zhang**. Fast quantum algorithm for attention

computation. *arXiv preprint arXiv:2307.08045*, 2023.

[2] Lianke Qin, Zhao Song, **Ruizhe Zhang**. A General Algorithm for Solving Rank-one Matrix Sensing. *arXiv preprint arXiv:2303.12298*, 2023.

[3] Hongru Yang, Ziyu Jiang, **Ruizhe Zhang**, Zhangyang Wang, Yingbin Liang. Convergence and Generalization of Wide Neural Networks with Large Bias. *arXiv preprint arXiv:2301.00327*, 2023.

[4] Baihe Huang, Shunhua Jiang, Zhao Song, Runzhou Tao, **Ruizhe Zhang**. A Faster Quantum Algorithm for Semidefinite Programming via Robust IPM Framework. *arXiv preprint arXiv:2207.11154*, 2022.

[5] Zhao Song, Baocheng Sun, Omri Weinstein, **Ruizhe Zhang**. Sparse Fourier Transform over Lattices: A Unified Approach to Signal Reconstruction. *arXiv preprint arXiv:2205.00658*, 2022.

[6] Baihe Huang, Zhao Song, Omri Weinstein, Hengjie Zhang, **Ruizhe Zhang**. A Dynamic Fast Gaussian Transform. *arXiv preprint arXiv:2202.12329*, 2022.

[7] Zhao Song, Lichen Zhang, **Ruizhe Zhang**. Training Multi-Layer Over-Parametrized Neural Network in Subquadratic Time. *arXiv preprint arXiv:2112.07628*, 2021.

[8] Baihe Huang, Zhao Song, Runzhou Tao, **Ruizhe Zhang**, Danyang Zhuo. InstaHide's Sample Complexity When Mixing Two Private Images. *arXiv preprint arXiv:2011.11877*, 2020.

TALKS

Quantum Speedups of Continuous Sampling and Optimization Problems

- Invited talk at IPAM CQC 2023 Workshop I Oct, 2023
- Invited talk at George Mason University Theory Seminar Apr, 2023
- Invited talk at MIT Quantum Information Processing Seminar Jan, 2023

Quantum Algorithm for Ground State Energy Estimation Using Circuit Depth With Exponentially Improved Dependence on Precision

- Contributed talk at APS March Meeting 2023 Mar, 2023

Solving SDP Faster: A Robust IPM Framework and Efficient Implementation

- Invited talk at UT Austin Theory Seminar Apr, 2023
- The 63rd Annual Symposium on Foundations of Computer Science (FOCS 2022) Nov, 2022

Ground State Energy and Property Estimation with Low Quantum Circuit Depth

- Invited talk at QUARK Lab at Peking University Oct, 2022

Hyperbolic Concentration, Anti-concentration, and Discrepancy

- The 26th International Conference on Randomization and Computation (RANDOM 2022) Sept, 2022

On the Quantum Fine-Grained Complexity of Closest Pair and Related Problems

- Invited talk at University of Washington Theory Seminar May, 2022

Computing Ground State Properties with Early Fault-Tolerant Quantum Computers

- Contributed talk at APS March Meeting 2022 Mar, 2022

Symmetric Sparse Boolean Matrix Factorization and Applications

- The 13th Innovations in Theoretical Computer Science Conference (ITCS 2022) Feb, 2022

Quantum Speedup for Annealing and Sampling

- Invited talk at Simons Institute reading group Dec, 2021

Quantum Meets the Minimum Circuit Size Problem

- Second Kyoto Workshop on Quantum Information, Computation, and Foundation (QICF 2021) Sept, 2021

On the Quantum Complexity of Closest Pair and Related Problems

- Computational Complexity Conference (CCC 2020) Sept, 2020
- The 15th Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC 2020) Aug, 2020

TEACHING

At UT Austin

- TA for CS395T, Coding Theory (graduate class) Spring 2022
- TA for CS388R, Randomized Algorithms (graduate class) Fall 2021
- TA for CS388T, Theory of Computation (graduate class) Spring 2020

At Fudan University

- TA for Data Structure (undergraduate class) Fall 2016

SERVICES

Conference referee:

- ESA 2020, Eurocrypt 2021, QIP 2021, AQIS 2021, QIP 2022, STOC 2022, ICML 2022, SODA 2023, QIP 2023, AAI 2023, STACS 2023, STOC 2023, TQC 2023, CRYPTO 2023, FOCS 2023, NeurIPS 2023, QIP 2023, AAI 2024, ICLR 2024, AISTATS 2024

Journal referee:

- SIAM Journal on Computing, SIAM Journal on Optimization, Quantum, PRX Quantum, Physical Review Letter, Physical Review A, Physical Review Research, Transactions on Information Theory, Advances in Engineering Software, npj Quantum Information, ACM Journal on Autonomous Transportation Systems

CODING SKILLS

C/C++, Python, Matlab, Latex