

Xiaodi Wu

Assistant Professor

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Research interests

- Quantum Information and Computation, Quantum Cryptography, Quantum Programming Languages, Mathematical Optimization, Theory of Computation,

Research positions

- 06/2017–
present **Assistant Professor**, *University of Maryland*, College Park, MD.
Department of Computer Science and Institute for Advanced Computer Studies
Fellow of the Joint Center for Quantum Information and Computer Science (QICS)
- 09/2015–
06/2017 **Assistant Professor**, *University of Oregon*, Eugene, OR.
Department of Computer and Information Science.
- 09/2013–
09/2015 **Postdoctoral Associate**, *Massachusetts Institute of Technology*, Cambridge, MA.
Advisor: Aram Harrow and Scott Aaronson.
- 01/2014–
05/2014 **Simons Research Fellow**, *Simons Institute for the Theory of Computing*, *University of California*, Berkeley, CA, Advisor: Umesh Vazirani.
- Summer
2009,2010 **Research Assistant**, *Institute for Quantum Computing*, *University of Waterloo*, Waterloo, Canada, Advisor: John Watrous.

Education

- 09/2008–
12/2013 **Ph.D. in Computer Science**, *University of Michigan*, Ann Arbor, MI, *GPA: 4.0/4.0*.
Thesis title: *Space-efficient Simulations of Quantum Interactive Proofs*. Advisor: Prof Yaoyun Shi.
- 08/2004–
07/2008 **B.S. in Mathematics and Physics**, *Tsinghua University*, Beijing, China, *GPA: 91/100*.
Thesis title : *Structure Properties of Codeword Stabilized Quantum Error-Correcting Codes*

Honors & Awards

- 02/2014 Plenary talk at the 17th Conference on Quantum Information Processing (QIP* 2014).
- 02/2013 Simons-Berkeley Research Fellowships (Spring 2014).
- 06/2012 Special issue of the 27th Conference on Computational Complexity (CCC 2012).
- 01/2012 Rackham Predoctoral Fellowship: departmental nominee, University of Michigan.
- 11/2011 Featured talk at the 15th Conference on Quantum Information Processing (QIP* 2012).
- 12/2009 Member of Tau Beta Pi, Engineering Honored Society.
- 06/2008 Distinguished Undergraduate Degree Thesis, Tsinghua University.
- 06/2008 Chi-Sun YEH Prize (highest award to undergraduate physics majors), Tsinghua University.
- 06/2007 Microsoft Young Fellow Scholarship.

*QIP is the most prestigious and competitive conference in theoretical aspects of quantum information science. Annually out of ~ 220 submissions, ~ 9 are selected as featured talks, ~ 25 as contributed talks and the ~ 4 best results as plenary talks.

Teaching experience

- Instructor **Introduction to Quantum Computation**, *University of Maryland*, undergraduate-level CS course, Spring 2018.
- Instructor **Complexity Theory (CMSC 652)**, *University of Maryland*, graduate-level CS major course, Fall 2017.
- Instructor **Intermediate Data Structure (CIS 313)**, *University of Oregon*, undergraduate-level CS major course, Winter 2016, Fall 2016, Winter 2017.
- Instructor **Introduction to Quantum Information Processing (CIS 410/510)**, *University of Oregon*, undergraduate/graduate level course, Spring 2016, Spring 2017.
- Teaching Assistant **Computational Complexity (EECS 574)**, *University of Michigan*, Ann Arbor, graduate-level course, Fall 2010.
- Teaching Assistant **Discrete Mathematics (EECS 203)**, *University of Michigan*, Ann Arbor, undergraduate-level course, Winter 2010.

Patent

- Oct. 2016 **“Physical Randomness Extractors”**, *Kai-Min Chung, Yaoyun Shi, Xiaodi Wu, US Patent 9,471,280.*

Professional service

- PC Member
- ◇ The 9th Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC 2014).
 - ◇ The 20th Annual Conference on Quantum Information Processing (QIP 2017).
 - ◇ The 21th Annual Conference on Quantum Information Processing (QIP 2018).
- Reviewer
- ◇ Conferences: STOC, FOCS, QIP, SODA, CCC, ICALP, ITCS, CRYPTO, CCS, AsiaCrypt, TCC, and ISAAC for multiple years.
 - ◇ Journals: SIAM Journal of Computing, Nature Communications, Quantum Information and Computation, International Journal of Quantum Information, Theoretical Computer Science, Theory of Computing, and Physical Review Letter.

Publications

(The authors of papers in theoretical computer science are listed by the alphabetical order of the last name unless explicitly described.)

Journals

- ◇ Jeongwan Haah, Aram W. Harrow, Zhengfeng Ji, **Xiaodi Wu** and Nengkun Yu, *Sample-optimal tomography of quantum states*. IEEE Information Transaction on Information Theory, Volume: 63, Issue: 9, pp. 5628 – 5641.
- ◇ Aram W. Harrow, Anand Natarajan, and **Xiaodi Wu**, *An improved semidefinite programming hierarchy for testing entanglement*, Communications in Mathematical Physics, Volume 352, Issue 3, pp 881–904. Also available at arXiv:1506.08834, 2015.
- ◇ Yaoyun Shi and **Xiaodi Wu**, *Epsilon-net method for optimizations over separable states*. Theoretical Computer Science, 598:51–63, 2015.
- ◇ Gus Gutoski and **Xiaodi Wu**, *Parallel approximation of min-max problems with applications to classical and quantum zero-sum games*. Computational Complexity, 22(2):385-428, 2013, the **special issue** of CCC 2012.

- ◇ (by contribution) **Xiaodi Wu** and Runyao Duan, *Exact Quantum Search by Parallel Unitary Discrimination Schemes*, Physical Review A, **78**, 012303 (2008). Selected for the July 2008 issue of Virtual Journal of Quantum Information.
- ◇ (by contribution) **Xiaodi Wu** and Gui Lu Long, *Verifier-based Algorithm for Unsorted Database Search Problem*, International Journal of Quantum Information, vol.**5** no.**4**, pp **597 - 604** (2007).
- ◇ (by contribution) **Xiao-di Wu**, Yong-tao Huang, Xin-kun Ma, *Data processing and software realization of wave-lengths of spectrum during CCD measurement*, Experimental Technology and Management, vol.**24**, no.**4** p**48-51** (2006).

Peer-reviewed Conferences with Published Proceedings

- ◇ (by contribution) Mingsheng Ying, Shenggang Ying, and **Xiaodi Wu**, *Invariants of Quantum Programs: Characterizations and Generation*, to appear at the 44th ACM SIGPLAN Symposium on Principles of Programming Languages (POPL 2017).
- ◇ Jeongwan Haah, Aram W. Harrow, Zhengfeng Ji, **Xiaodi Wu** and Nengkun Yu, *Sample-optimal tomography of quantum states*. In Proceedings of the ACM 48th Annual Symposium on the Theory of Computing (STOC) 2016, available at arXiv:1508.01797.
- ◇ Aram W. Harrow, Anand Natarajan, and **Xiaodi Wu**, *Tight SoS-degree bounds for approximate Nash equilibria*. In Proceedings of the Computational Complexity Conference (CCC) 2016.
- ◇ Kai-Min Chung, **Xiaodi Wu**, and Henry Yuen, *Parallel repetition for entangled k -player games via fast quantum search*. In Proceedings of the Computational Complexity Conference (CCC) 2015, also available at arXiv:1501.00033, 2015.
- ◇ Yaoyun Shi and **Xiaodi Wu**, *Epsilon-net method for optimizations over separable states*. In Proceedings of the 39th International Colloquium on Automata, Languages and Programming (ICALP 2012), pp. 798–809.
- ◇ Gus Gutoski and **Xiaodi Wu**, *Parallel approximation of min-max problems with applications to classical and quantum zero-sum games*. In Proceedings of the 27th Annual IEEE Conference on Computational Complexity (CCC 2012), pp. 21–31.

Peer-reviewed Conferences without Published Proceedings

- ◇ Yi-Hsiu Chen, Kai-Min Chung, Ching-Yi Lai, Salil P. Vadhan, and **Xiaodi Wu**, *Computational Notions of Quantum Min-Entropy*, at the 7th International Conference on Quantum Cryptography (QCrypt 2017). also available at arXiv: 1704.07309.
- ◇ Aram W. Harrow, Anand Natarajan, and **Xiaodi Wu**, *Limitations of semidefinite programs for separable states and entangled games*, at the 20th Conference on Quantum Information Processing (QIP 2017).
- ◇ Kai-Min Chung, Yaoyun Shi, and **Xiaodi Wu**, *General randomness amplification with non-signaling security*, at the 20th Conference on Quantum Information Processing (QIP 2017).
- ◇ Jeongwan Haah, Aram W. Harrow, Zhengfeng Ji, **Xiaodi Wu** and Nengkun Yu, *Sample-optimal tomography of quantum states*, at the 19th Conference on Quantum Information Processing (QIP 2016), available at arXiv:1508.01797.
- ◇ Kai-Min Chung, Yaoyun Shi, and **Xiaodi Wu**, *Physical Randomness Extractors*, appeared as a **plenary talk** at the 17th Conference on Quantum Information Processing (QIP 2014), also available at arXiv:1402.4797v2.

- ◇ Yaoyun Shi and **Xiaodi Wu**, *Epsilon-net method for optimizations over separable states*. **Contributed talk** at the 15th Workshop on Quantum Information Processing (QIP 2012), also available at arXiv:1112.0808, 2011.
- ◇ Gus Gutoski and **Xiaodi Wu**, *Parallel approximation of min-max problems with applications to classical and quantum zero-sum games*. **Featured talk** at the 15th Workshop on Quantum Information Processing (QIP 2012), available at arXiv:1011.2787, 2010.
- ◇ Zhengfeng Ji and **Xiaodi Wu**, *Non-Identity Check Remains QMA-Complete for Short Circuits*, **contributed talk** at the 9th Asian Conference on Quantum Information Science (AQIS09), also available at arXiv:0906.5416, 2009.

Manuscripts

- ◇ Tongyang Li and **Xiaodi Wu**, *Quantum query complexity of entropy estimation*, manuscript, 2017.
- ◇ **Xiaodi Wu**, Penghui Yao, and Henry Yuen, *Raz-McKenzie simulation with the inner product gadget*, manuscript, 2017. also available at ECC TR17-010.
- ◇ Aram Harrow, Maris Ozols, Tianyi Peng, and **Xiaodi Wu**, *Simulating large quantum circuits on a small quantum computer*, manuscript, 2016.
- ◇ **Xiaodi Wu** and Henry Yuen, *On the limits of communication with non-local resources*, manuscript, 2015.
- ◇ Kai-Min Chung, Xin Li, and **Xiaodi Wu**, *Multi-Source Randomness Extractors Against Quantum Side Information, and their Applications*, manuscript, also available at arXiv:1411.2315, 2014.
- ◇ Yaoyun Shi, Wei Yu, and **Xiaodi Wu**, *Limits of Quantum One-way Communication by Matrix Hypercontractive Inequalities*, manuscript, 2013.
- ◇ **Xiaodi Wu**, *Parallelized Solution to Semidefinite Programings in Quantum Complexity Theory*, Technical Report, also available at arXiv:1009.2211, 2010.
- ◇ **Xiaodi Wu**, *Equilibrium Value Method for the proof of QIP=PSPACE*, manuscript, available at arXiv:1004.0264, 2010.

Invited Talks

- 07/2017 **Quantum query complexity of entropy estimation.**
Microsoft Quantum Algorithms Workshop, Redmond.
- 04/2017 **Quantum query complexity of entropy estimation.**
Microsoft Research, Redmond.
- 03/2017 **General randomness amplification with non-signaling security.**
IQI Seminar, Caltech.
- 01/2017 **General randomness amplification with non-signaling security.**
The 20th Workshop on Quantum Information Processing (QIP 2017).
- 08/2016 **Limitations of monogamy, Tsirelson-type bounds, and other semidefinite programs in quantum information.**
QMA(2) Workshop, QUICS, University of Maryland
- 02/2016 **Device-independent Quantum Cryptography.**
Oregon Crypto Meeting, Oregon State University

- 12/2015 **Limitations of monogamy, Tsirelson-type bounds, and other semidefinite programs in quantum information.**
IQI Seminar, Caltech
- 06/2015 **Randomness Extraction in the Presence of Quantum Side Information.**
1st Trustworthy Quantum Information Workshop, Ann Arbor, USA
- 05/2015 **New Upper and Lower Bounds for Entanglement Testing.**
Microsoft Research, Redmond.
- 05/2015 **Randomness Extraction in the Presence of Quantum Side Information.**
Simon's Institute for the Theory of Computing, UC Berkeley.
- 02/2015 **The Power and Limits of Quantum Computers.**
Colloquium, Department of Computer and Information Science, University of Oregon.
- 11/2014 **Improved Entanglement Detection with Tools from Algebraic Geometry.**
Colloquium, Institute for Quantum Computing, University of Waterloo.
- 11/2014 **Multi-Source Randomness Extractors Against Quantum Side Information.**
Theory Seminar, Virginia Commonwealth University, Richmond.
- 07/2014 **Physical Randomness Extractors.**
Gordon Research Seminar, Advances in Quantum Information Science, Stonehill College.
- 03/2014 **Physical Randomness Extractors.**
University of Michigan, Ann Arbor
- 02/2014 **Physical Randomness Extractors.**
IQI Seminar, Caltech.
- 05/2013 **Robust Full Randomness Extraction from Any Weak Source.**
Quantum Information Processing Seminar, MIT.
- 04/2013 **Equilibrium Value Method for Optimization Problems and its Applications in Quantum Computation,** IQI Seminar, Caltech.
- 04/2013 **Applications of Sum of Squares in Quantum Information.**
University of California, San Diego.
- 07/2012 **Epsilon-net method for optimizations over separable states..**
The 39th International Colloquium on Automata, Languages and Programming (ICALP'12).
- 06/2012 **Parallel approximation of min-max problems with applications to classical and quantum zero-sum games. .**
The 27th Annual IEEE Conference on Computational Complexity (CCC'12).
- 03/2012 **Epsilon-net method for optimizations over separable states.**
Tsinghua University.
- 12/2011 **Epsilon-net method for optimizations over separable states.**
The 15th Workshop on Quantum Information Processing (QIP'12).
- 12/2011 **Parallel approximation of min-max problems with applications to classical and quantum zero-sum games.**
The 15th Workshop on Quantum Information Processing (QIP'12).