

# Lijie Chen

## Curriculum Vitae

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📄 <https://chen-lijie.github.io/>  
Last updated: July 2023

### Education

- 2022–Now **Miller Institute for Basic Research in Science**, *University of California, Berkeley*.  
Miller Postdoctoral Fellow, hosted by Avishay Tal
- 2017–2022 **EECS**, *Massachusetts Institute of Technology*, Cambridge.  
S. M. in Electrical Engineering and Computer Science, advised by Ryan Williams  
S. M. thesis: *Fine-Grained Complexity Meets Communication Complexity*  
Ph.D. in Computer Science, advised by Ryan Williams  
Ph.D. thesis: *Better Hardness via Algorithms, and New Forms of Hardness versus Randomness*  
2017 Fall to 2018 summer: supported by an MIT Akamai Presidential Graduate Fellowship.  
2018 Fall to 2022 summer: Graduate Research Assistant, also partially supported by an IBM Fellowship.
- 2013–2017 **Institute for Interdisciplinary Information Sciences**, *Tsinghua University*, Beijing.  
Bachelor of Engineering in Computer Science and Technology

### Research Interests

- Computational Complexity
- Algorithm Design
- Fine-Grained Complexity
- Quantum Computing/Complexity

### Visiting and Internship

- 2023 Spring **Simons Institute for the Theory of Computing**, *Berkeley*.  
Research Fellow. Meta-Complexity.
- 2021 Summer **IBM T. J. Watson Research Center**, *New York (remote)*.  
PhD Quantum Research Summer Intern hosted by Ramis Movassagh.
- 2020 Summer **Google Inc.**, *Mountain View (remote)*.  
Research Intern hosted by Ravi Kumar.
- 2020 Winter (Jan - Feb) **Weizmann Institute of Science**, *Rehovot*.  
Visiting Student of Guy Rothblum.
- 2018 Fall **Simons Institute for the Theory of Computing**, *Berkeley*.  
Visiting Graduate Student. Lower Bounds in Computational Complexity.
- 2016 Spring **EECS**, *Massachusetts Institute of Technology*, Cambridge.  
Visiting Student, advised by Scott Aaronson.

### Selected Awards and Scholarships

- 2023 George M. Sprowls PhD Thesis in Computer Science Award
- 2022 EATCS Distinguished Dissertation Award 2022
- 2022 Miller Research Fellowship
- 2020 IBM Fellowship
- 2019 **FOCS 2019 Best Student Paper**
- 2019 **STOC 2019 Best Student Paper**
- 2017 MIT Akamai Presidential Graduate Fellowship
- 2017 International Collegiate Programming Contest, World Final, **6th place**
- 2016 Tsinghua Top-Grade Scholarship (**10 best undergraduate students** a year)
- 2013 International Olympiad in Informatics, Gold medal, **1st place**

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## Special Issue Invitations

*Invited journal articles considered to be among the top 5-10 papers in a given conference:*  
FOCS 2021, STOC 2021, STOC 2020, FOCS 2019, FOCS 2019, CCC 2018, FOCS 2017, CCC 2017

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## Professional Activities and Service

Program  
Committee

**ITCS 2022, FOCS 2022, CCC 2023**

Conference  
Reviewing

**FOCS, STOC, SODA, CCC, ITCS, ICALP, QIP, TCC, IPEC, COLT, RANDOM, ISAAC**

Journal  
Reviewing

**Journal of the ACM, Theory of Computing, Quantum, Algorithmica, Izvestiya: Mathematics, Journal of Privacy and Confidentiality**

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## Selected Publications

### Derandomization

**FOCS 2023** Derandomization vs Refutation: A Unified Framework for Characterizing Derandomization.  
**Lijie Chen**, Roei Tell, Ryan Williams.

**STOC 2023** When Arthur has Neither Random Coins nor Time to Spare: Superfast Derandomization of Proof Systems.  
**Lijie Chen**, Roei Tell.

**FOCS 2021** Hardness vs Randomness, Revised: Uniform, Non-Black-Box, and Instance-Wise.  
**Lijie Chen**, Roei Tell. **Invited to the SICOMP Special Issue for FOCS 2021**

**STOC 2021** Simple and fast derandomization from very hard functions: Eliminating randomness at almost no cost. **Lijie Chen**, Roei Tell.

### Circuit Lower Bounds from Algorithms

**FOCS 2020** Almost Everywhere Circuit Lower Bounds from Non-Trivial Derandomization.  
**Lijie Chen**, Xin Lyu, Ryan Williams.

**STOC 2020** Strong Average-Case Circuit Lower Bounds from Non-trivial Derandomization.  
**Lijie Chen**, Hanlin Ren. **Invited to the SICOMP Special Issue for STOC 2020**

**FOCS 2019** Efficient Construction of Rigid Matrices Using an NP Oracle.  
Josh Alman, **Lijie Chen**. **Machtey Award (Best Student Paper), Invited to the SICOMP Special Issue for FOCS 2019**

**FOCS 2019** Non-deterministic Quasi-Polynomial Time is Average-case Hard for ACC Circuits.  
**Lijie Chen**. **Invited to the SICOMP Special Issue for FOCS 2019**

### Hardness Magnification

**ITCS 2020** Beyond Natural Proofs: Hardness Magnification and Locality.  
**Lijie Chen**, Shuichi Hirahara, Igor Oliveira, Jan Pich, Ninad Rajgopal, Rahul Santhanam.

**FOCS 2019** Hardness Magnification for all Sparse NP Languages.  
**Lijie Chen**, Ce Jin, Ryan Williams.

**STOC 2019** Bootstrapping Results for Threshold Circuits “Just Beyond” Known Lower Bounds.  
**Lijie Chen**, Roei Tell. **Danny Lewin Best Student Paper Award**

### Other topics

**FOCS 2023** Polynomial-Time Pseudodeterministic Construction of Primes.  
Explicit **Lijie Chen**, Zhenjian Lu, Igor C. Oliveira, Hanlin Ren, Rahul Santhanam.  
Construction

**STOC 2021** Almost Optimal Super-Constant-Pass Streaming Lower Bounds for Reachability.  
Streaming **Lijie Chen**, Gillat Kol, Dmitry Paramonov, Raghuvansh Saxena, Zhao Song, Huacheng Yu.  
Lower Bounds **Invited to the SICOMP Special Issue for STOC 2021**

**CCC 2018** On The Hardness of Approximate and Exact (Bichromatic) Maximum Inner Product.  
Fine-grained **Lijie Chen**.  
complexity **Invited to the Toc Special Issue for CCC 2018**

- CCC 2017** Complexity-Theoretic Foundations of Quantum Supremacy Experiments.  
Quantum Scott Aaronson, **Lijie Chen**.  
Supremacy **Invited to the Toc Special Issue for CCC 2017**
- ITCS 2021** On Distributed Differential Privacy and Counting Distinct Elements.  
Differential **Lijie Chen**, Badih Ghazi, Ravi Kumar, Pasin Manurangsi.  
Privacy
- SODA 2022** Truly Low-Space Element Distinctness and Subset Sum via Pseudorandom Hash Functions.  
Low-space **Lijie Chen**, Ce Jin, Ryan Williams, Hongxun Wu.  
algorithms

## Teaching Experiences

- 2019 Fall Advanced Complexity Theory  
Teaching Asistant, Massachusetts Institute of Technology
- 2017 Spring Introduction to Computational Complexity  
Teaching Asistant, Tsinghua University

## Academic Talks

- 2022 - Feb Hardness vs Randomness, Revised: Uniform, Non-Black-Box, and Instance-Wise.  
**FOCS 2021**, Online
- 2022 - Feb Derandomization and its connections throughout complexity theory, Part II  
IAS, Computer Science/Discrete Mathematics Seminar II
- 2022 - Jan Quantum Merkle Trees.  
UC Berkeley Theory CS Seminar, Online
- 2021 - Dec Hardness vs Randomness, Revised: Uniform, Non-Black-Box, and Instance-Wise.  
CMU Theory Seminar, Online
- 2021 - Nov Hardness vs Randomness, Revised: Uniform, Non-Black-Box, and Instance-Wise.  
University of Washington Theory Seminar, Online
- 2021 - June Inverse-Exponential Correlation Bounds and Extremely Rigid Matrices from a New Derandom-  
ized XOR Lemma.  
**STOC 2021**, Online
- 2021 - June Simple and Fast Derandomization from Very Hard Functions: Eliminating Randomness at  
Almost No Cost.  
**STOC 2021**, Online
- 2021 - June Hardness vs Randomness, Revised: Uniform, Non-Black-Box, and Instance-Wise.  
Oxford-Warwick Complexity Meetings, Online
- 2021 - Feb On Distributed Differential Privacy and Counting Distinct Elements.  
Boston Area Differential Privacy Seminar Series, Online
- 2021 - Jan On Distributed Differential Privacy and Counting Distinct Elements.  
**ITCS 2021**, Online
- 2020 - Nov Almost Everywhere Circuit Lower Bounds from Non-Trivial Derandomization.  
**FOCS 2020**, Online
- 2020 - Sep Simple and fast derandomization from very hard functions: Eliminating randomness at almost  
no cost.  
SIGMA ICT CAS, Online
- 2020 - July Sharp Threshold Results for Computational Complexity.  
Oxford-Warwick Complexity Meetings, Online
- 2020 - June Strong Average-Case Lower Bounds from Non-trivial Derandomization.  
**STOC 2020**, Online
- 2020 - June Sharp threshold results for computational complexity.  
**STOC 2020**, Online

- 2019 - 2020 Strong Average-Case Circuit Lower Bounds from Non-trivial Derandomization  
Theory Seminar, University of Chicago  
Lower Bounds in Computational Complexity Reunion, Simons Institute  
Theory Seminar, Weizmann Institute of Science  
Theory Seminar, Hebrew University of Jerusalem  
Theory Seminar, Technion - Israel Institute of Technology  
Theoretical Computer Science and Discrete Math Seminars, Institute for Advanced Study  
DIMAP Seminar, University of Warwick
- 2019 Efficient Construction of Rigid Matrices Using an NP Oracle  
[FOCS 2019](#)
- 2019 Non-deterministic Quasi-Polynomial Time is Average-case Hard for ACC Circuits  
[FOCS 2019](#)
- 2019 On Algebraic and Number Theoretical Methods in Fine-Grained Complexity  
Nanjing University
- 2019 Recent Developments on the Algorithmic Approach Towards Circuit Lower Bounds  
Tsinghua University
- 2019 Recent Developments in Fine-Grained Complexity via Communication Complexity  
Tsinghua University
- 2019 Stronger Connections Between Circuit Analysis and Circuit Lower Bounds, via PCPs of Proximity  
[CCC 2019](#)
- 2019 Bootstrapping Results for Threshold Circuits “Just Beyond” Known Lower Bounds  
[STOC 2019](#)
- 2019 Non-deterministic Quasi-Polynomial Time is Average-case Hard for ACC Circuits  
Theory Seminar of UT Austin  
Harvard TGINF  
CMU Theory Lunch
- 2019 Classical Algorithms from Quantum and Arthur-Merlin Communication Protocols  
[ITCS 2019](#)
- 2019 An Equivalence Class for Orthogonal Vectors  
[SODA 2019](#)
- 2018 Recent Structure Lemmas for Depth-Two Threshold Circuits  
Simons Institute for the Theory of Computing
- 2018 On The Hardness of Approximate and Exact (Bichromatic) Maximum Inner Product  
[CCC 2018](#)  
Algorithms & Complexity Seminar, MIT
- 2017 On The Power of Statistical Zero Knowledge  
[FOCS 2017](#)  
Algorithms & Complexity Seminar, MIT
- 2017 Complexity-Theoretic Foundations of Quantum Supremacy Experiments  
[CCC 2017](#)
- 2016 Adaptivity vs Postselection  
[ISAAC 2016](#)
- 2016 Pure Exploration of Multi-armed Bandit Under Matroid Constraints  
[COLT 2016](#)

## Journal Publications

- 5 Beyond Natural Proofs: Hardness Magnification and Locality.  
[Lijie Chen](#), Shuichi Hirahara, Igor Oliveira, Jan Pich, Ninad Rajgopal, Rahul Santhanam.  
[Journal of the ACM](#), 2022.
- 4 Efficient Construction of Rigid Matrices Using an NP Oracle.  
Josh Alman, [Lijie Chen](#).  
[SIAM Journal on Computing](#), 2022.

- 3 Strong average-case circuit lower bounds from nontrivial derandomization.  
[Lijie Chen](#), Hanlin Ren.  
[SIAM Journal on Computing](#), 2021.
- 2 On The Hardness of Approximate and Exact (Bichromatic) Maximum Inner Product.  
[Lijie Chen](#).  
[Theory of Computing](#), 2020.
- 1 On The Power of Statistical Zero Knowledge.  
Adam Bouland, [Lijie Chen](#), Dhiraj Holden, Justin Thaler, Prashant Nalini Vasudevan.  
[SIAM Journal on Computing](#), 2020.

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## Conference Publications

- 48 Polynomial-Time Pseudodeterministic Construction of Primes.  
[Lijie Chen](#), Zhenjian Lu, Igor C. Oliveira, Hanlin Ren, Rahul Santhanam  
Accepted to [FOCS 2023](#).
- 47 Derandomization vs Refutation: A Unified Framework for Characterizing Derandomization.  
[Lijie Chen](#), Roei Tell, Ryan Williams  
Accepted to [FOCS 2023](#).
- 46 Weighted Pseudorandom Generators via Inverse Analysis of Random Walks and Shortcutting.  
[Lijie Chen](#), William Hoza, Xin Lyu, Avishay Tal and Hongxun Wu  
Accepted to [FOCS 2023](#).
- 45 New PRGs for Unbounded-width/Adaptive-order Read-once Branching Programs.  
[Lijie Chen](#), Xin Lyu, Avishay Tal, Hongxun Wu  
[ICALP 2023](#).
- 44 When Arthur has Neither Random Coins nor Time to Spare: Superfast Derandomization of Proof Systems.  
[Lijie Chen](#), Roei Tell  
[STOC 2023](#).
- 43 New Lower Bounds and Derandomization for ACC, and a Derandomization-centric View on the Algorithmic Method.  
[Lijie Chen](#)  
[ITCS 2023](#).
- 42 Black-box Constructive Proofs are Unavoidable.  
[Lijie Chen](#), Ryan Williams, Tianqi Yang  
[ITCS 2023](#).
- 41 Towards Multi-Pass Streaming Lower Bounds for Optimal Approximation of Max-Cut.  
[Lijie Chen](#), Gillat Kol, Dmitry Paramonov, Raghuvansh Saxena, Zhao Song, Huacheng Yu  
[SODA 2023](#).
- 40 Unstructured Hardness to Average-Case Randomness.  
[Lijie Chen](#), Ron D. Rothblum, Roei Tell  
[FOCS 2022](#).
- 39 Extremely Efficient Constructions of Hash Functions, with Applications to Hardness Magnification and PRFs.  
[Lijie Chen](#), Jiatu Li, Tianqi Yang  
[CCC 2022](#).
- 38 Improved Merlin-Arthur Protocols for Central Problems in Fine-Grained Complexity.  
Shyan Akmal, [Lijie Chen](#), Ce Jin, Malvika Raj, Ryan Williams  
[ITCS 2022](#).
- 37 Average-case Hardness of NP and PH from Worst-case Fine-grained Assumptions.  
[Lijie Chen](#), Shuichi Hirahara, Neekon Vafa.  
[ITCS 2022](#).
- 36 Truly Low-Space Element Distinctness and Subset Sum via Pseudorandom Hash Functions.  
[Lijie Chen](#), Ce Jin, Ryan Williams, Hongxun Wu.  
[SODA 2022](#).

- 35 Constructive Separations and Their Consequences.  
[Lijie Chen](#), Ce Jin, Rahul Santhanam, Ryan Williams.  
[FOCS 2021](#).
- 34 Hardness vs Randomness, Revised: Uniform, Non-Black-Box, and Instance-Wise.  
[Lijie Chen](#), Roei Tell.  
[FOCS 2021](#).
- 33 Majority vs. Approximate Linear Sum and average-case complexity below NC1.  
[Lijie Chen](#), Zhenjian Lu, Xin Lyu, Igor Oliveira.  
[ICALP 2021](#).
- 32 Near-Optimal Two-Pass Streaming Algorithm for Sampling Random Walks over Directed Graphs.  
[Lijie Chen](#), Gillat Kol, Dmitry Paramonov, Raghuvansh Saxena, Zhao Song, Huacheng Yu.  
[ICALP 2021](#).
- 31 Almost Optimal Super-Constant-Pass Streaming Lower Bounds for Reachability.  
[Lijie Chen](#), Gillat Kol, Dmitry Paramonov, Raghuvansh Saxena, Zhao Song, Huacheng Yu.  
[STOC 2021](#). **(Invited to the SICOMP Special Issue for STOC 2021)**
- 30 Inverse-Exponential Correlation Bounds and Extremely Rigid Matrices from a New Derandomized XOR Lemma.  
[Lijie Chen](#), Xin Lyu.  
[STOC 2021](#).
- 29 Simple and fast derandomization from very hard functions: Eliminating randomness at almost no cost.  
[Lijie Chen](#), Roei Tell.  
[STOC 2021](#).
- 28 On Distributed Differential Privacy and Counting Distinct Elements.  
[Lijie Chen](#), Badih Ghazi, Ravi Kumar, Pasin Manurangsi.  
[ITCS 2021](#).
- 27 Almost Everywhere Circuit Lower Bounds from Non-Trivial Derandomization.  
[Lijie Chen](#), Xin Lyu, Ryan Williams.  
[FOCS 2020](#).
- 26 On Exponential-Time Hypotheses, Derandomization, and Circuit Lower Bounds.  
[Lijie Chen](#), Ron Rothblum, Roei Tell, Eylon Yogev.  
[FOCS 2020](#).
- 25 Sharp Threshold Results for Computational Complexity.  
[Lijie Chen](#), Ce Jin, Ryan Williams.  
[STOC 2020](#).
- 24 Strong Average-Case Circuit Lower Bounds from Non-trivial Derandomization.  
[Lijie Chen](#), Hanlin Ren.  
[STOC 2020](#). **(Invited to the SICOMP Special Issue for STOC 2020)**
- 23 Beyond Natural Proofs: Hardness Magnification and Locality.  
[Lijie Chen](#), Shuichi Hirahara, Igor Oliveira, Jan Pich, Ninad Rajgopal, Rahul Santhanam.  
[ITCS 2020](#).
- 22 Hardness Magnification for all Sparse NP Languages.  
[Lijie Chen](#), Ce Jin, Ryan Williams.  
[FOCS 2019](#).
- 21 Efficient Construction of Rigid Matrices Using an NP Oracle.  
 Josh Alman, [Lijie Chen](#).  
[FOCS 2019](#). **(Machtvey Award (Best Student Paper))**  
**(Invited to the SICOMP Special Issue for FOCS 2019)**
- 20 Non-deterministic Quasi-Polynomial Time is Average-case Hard for ACC Circuits.  
[Lijie Chen](#).  
[FOCS 2019](#). **(Invited to the SICOMP Special Issue for FOCS 2019)**

- 19 Broadcast Congested Clique: Planted Cliques and Pseudorandom Generators.  
[Lijie Chen](#), Ofer Grossman.  
[PODC 2019](#).
- 18 Relations and Equivalences Between Circuit Lower Bounds and Karp-Lipton Theorems.  
[Lijie Chen](#), Dylan McKay, Cody Murray, Ryan Williams.  
[CCC 2019](#).
- 17 Stronger Connections Between Circuit Analysis and Circuit Lower Bounds, via PCPs of Proximity.  
[Lijie Chen](#), Ryan Williams.  
[CCC 2019](#).
- 16 Bootstrapping Results for Threshold Circuits “Just Beyond” Known Lower Bounds.  
[Lijie Chen](#), Roei Tell.  
[STOC 2019](#). **(Danny Lewin Best Student Paper Award)**
- 15 Classical Algorithms from Quantum and Arthur-Merlin Communication Protocols.  
[Lijie Chen](#), Ruosong Wang.  
[ITCS 2019](#).
- 14 An Equivalence Class for Orthogonal Vectors.  
[Lijie Chen](#), Ryan Williams.  
[SODA 2019](#).
- 13 Fine-grained Complexity Meets  $IP = PSPACE$ .  
[Lijie Chen](#), Shafi Goldwasser, Kaifeng Lyu, Guy N. Rothblum, Aviad Rubinfeld.  
[SODA 2019](#).
- 12 Nearly Optimal Separation Between Partially And Fully Retroactive Data Structures.  
[Lijie Chen](#), Erik D. Demaine, Yuzhou Gu, Virginia Vassilevska Williams, Yinzhan Xu, Yuancheng Yu.  
[SWAT 2018](#).
- 11 An Improved Algorithm for Incremental DFS Tree in Undirected Graphs.  
[Lijie Chen](#), Ran Duan, Ruosong Wang, Hanrui Zhang, Tianyi Zhang.  
[SWAT 2018](#).
- 10 On The Hardness of Approximate and Exact (Bichromatic) Maximum Inner Product.  
[Lijie Chen](#).  
[CCC 2018](#). **(Invited to the Toc Special Issue for CCC 2018)**
- 9 On The Power of Statistical Zero Knowledge.  
Adam Bouland, [Lijie Chen](#), Dhiraj Holden, Justin Thaler, Prashant Nalini Vasudevan.  
[FOCS 2017](#). **(Invited to the SICOMP Special Issue for FOCS 2017)**
- 8 Nearly Optimal Sampling Algorithms for Combinatorial Pure Exploration.  
[Lijie Chen](#), Anupam Gupta, Jian Li, Mingda Qiao and Ruosong Wang.  
[COLT 2017](#).
- 7 Towards Instance Optimal Bounds for Best Arm Identification.  
[Lijie Chen](#), Jian Li, Mingda Qiao.  
[COLT 2017](#).
- 6 Complexity-Theoretic Foundations of Quantum Supremacy Experiments.  
Scott Aaronson, [Lijie Chen](#).  
[CCC 2017](#). **(Invited to the Toc Special Issue for CCC 2017)**.
- 5 Nearly Instance Optimal Sample Complexity Bounds for Top-k Arm Selection.  
[Lijie Chen](#), Jian Li, Mingda Qiao.  
[AISTATS 2017](#).
- 4 K-Memory Strategies in Repeated Games.  
[Lijie Chen](#), Fangzhen Lin, Pingzhong Tang, Kangning Wang, Ruosong Wang, Shiheng Wang.  
[AAMAS 2017 \(extended abstract\)](#).
- 3 Bounded rationality of restricted Turing machines.  
[Lijie Chen](#), Pingzhong Tang, Ruosong Wang.  
[AAAI 2017](#).

- 2 Adaptivity vs Postselection, and Hardness Amplification in Polynomial Approximation.  
**Lijie Chen.**  
**ISAAC 2016 (Best Student Paper).**
- 1 Pure Exploration of Multi-armed Bandit Under Matroid Constraints.  
**Lijie Chen**, Anupum Gupta, Jian Li.  
**COLT 2016.**

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## Languages

- Chinese (Native)
- English (Fluent)
- Japanese (N2)