

Yinchen Liu

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EDUCATION

Tsinghua University

Sep 2023 – Jun 2027

Bachelor of Engineering (Expected)

Institute for Interdisciplinary Information Sciences (IIIS), Yao Class

Beijing, China

- **Overall GPA:** 4.00/4.00, Rank: 1/91

Carnegie Mellon University

Feb 2026 – Aug 2026

Research Intern

Pittsburgh, USA

- **Advisor:** Prof. Ryan O'Donnell
- **Topic:** High dimensional expanders (HDX) and applications in probabilistically checkable proof (PCPs).

Shanghai High School

Sep 2020 – Jun 2023

Mathematics Class

Shanghai, China

- Mathematics track.

RESEARCH INTERESTS

Boolean analysis, communication complexity, streaming algorithms, spectral graph theory, high dimensional expanders

MANUSCRIPT AND PUBLICATION

Turnstile Streaming Algorithms Might (Still) as Well Be Linear Sketches, for Polynomial-Length Streams.

Cheng Jiang, **Yinchen Liu**, Huacheng Yu.

To Appear in *IEEE Symposium on Foundations of Computer Science (FOCS)*, 2026. [[arxiv](#)][[video](#)]

On the Complexity of Minimizing Qubits in Polynomial-Encoded Quantum Circuits.

Zhengfeng Ji, **Yinchen Liu**, Zhe'ou Zhou.

To Appear in *The Theory of Quantum Computation, Communication and Cryptography (TQC)*, 2026.

Exploiting the complexity of Lattice Isomorphism Problem via Irreducible Decomposition.

Kaijie Jiang, **Yinchen Liu**.

To Appear in *International Cryptology Conference (CRYPTO)*, 2026. [[eprint](#)]

Adaptivity Gaps for Stochastic Probing with Subadditive Functions.

Jian Li, **Yinchen Liu**, Yiran Zhang.

In *IEEE Symposium on Foundations of Computer Science (FOCS)*, 2025. [[arxiv](#)] [[video](#)]

On the Positive and Negative p -Energies of Graphs under Edge Addition.

Quanyu Tang, **Yinchen Liu**, Wei Wang*.

In *Discrete Applied Mathematics*, vol. 388, 31 July 2026, pp. 25–33. [[journal](#)][[arxiv](#)]

On a Conjecture of Nikiforov Concerning the Minimal p -energy of Connected graphs.

Quanyu Tang, **Yinchen Liu**, Wei Wang*.

Submitted to *Linear Algebra and Its Applications*. [[arxiv](#)]

Path-Minimality of p -Energy for Connected Graphs.

Yinchen Liu, Quanyu Tang.

Submitted to *Journal of Combinatorial Theory, Series B*. [[arxiv](#)]

RESEARCH EXPERIENCE

Succinct PCPs from High-Dimensional Complexes

Feb 2026 – Aug 2026

Advisor: Prof. Ryan O'Donnell

Carnegie Mellon University, Department of Computer Science

- Investigated the algebraic structure of Kaufman–Oppenheim (KO) complexes and various Ramanujan complexes.
- Constructed *strongly explicit* sorting networks supported on KO complexes.
- Analyzed connection of routing/sorting primitives of KO complexes with succinct quasilinear PCP constructions.

Separation for QCMA^{cc} and QMA^{cc}

Apr 2025 – Aug 2025

Advisor: Prof. Penghui Yao

Nanjing University, Department of Computer Science and Technology

- Developed formal analytic framework for Grassmannian manifolds and generalized Legendre polynomials to support MA^{cc} rectangle lower bounds.
- Working on variants of communication lifting theorems for MA^{cc} and QCC.

PROJECT EXPERIENCE

Reduction Theorem from Turnstile Streaming Algorithms to Linear Sketching

Sep 2025 – Apr 2026

Advisor: Prof. Huacheng Yu

Princeton University, Department of Computer Science

- Established a stochastic analysis-based proof for a specific family of problems: approximation problems.
- Developed a Fourier-analytic framework, leveraging additive combinatorics to analyze the low-dimensional lattice structure of heavy Fourier frequencies.
- Primary author of the manuscript, responsible for formulating and writing the majority of the formal proofs.

Upper Bound on Adaptivity Gap for Stochastic Probing with Subadditive Objectives

Aug 2024 – Nov 2024

Advisor: Prof. Jian Li

Tsinghua University, Institute for Interdisciplinary Information Sciences

- Obtained a first polylog upper bound on general subadditive functions for such problems.
- Established a key inequality leveraging a novel algorithmic framework proposed by a coauthor.
- Refined the overall analysis to obtain a tight upper bound in the case of unweighted max-of-sum objectives.
- Contributed to approximately two-thirds of the manuscript, including overview and formal proof writing.

COURSEWORK

Mathematics

Calculus A(1, 2)

Probability and Statistics

Second Course of Abstract Algebra (Graduate level)

Abstract Algebra

Honors Algebra

Representation Theory of Groups (Graduate level)

Homological and Commutative Algebra (Graduate level)

Computer Science

Quantum Computer Science

Fundamentals of Cryptography

Quantum Complexity Theory (Graduate level)

Theory of Computation

Algebra and Computation

Design and Analysis of Algorithms (Graduate level)

Topics in Quantum Computing

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HONORS AND AWARDS

Individual Reviewer for *The Electronic Journal of Combinatorics*.

2026

Individual Reviewer for *International Cryptology Conference (crypto)*, 2025.

2025

Academic Excellence Scholarship

2024 & 2025

Chinese National Scholarship

2024 & 2025

Secondary Scholarship for Freshmen

2023

S.-T. Yau College Student Mathematics Contests Merit Award in Probability and Statistics track

2023

S.-T. Yau College Student Mathematics Contests Merit Award in Algebra and Number Theory track

2023

Alibaba Global Mathematics Competition Merit Award

2022

REFERENCES

Prof. Jian Li

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Tsinghua University

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Prof. Penghui Yao

Department of Computer Science and Technology
Nanjing University

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Prof. Huacheng Yu

Department of Computer Science
Princeton University

Email: hy2@cs.princeton.edu

Prof. Ryan O'Donnell

Department of Computer Science
Carnegie Mellon University

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