

# Yupan Liu

## Curriculum Vitae

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## Research Interests

My research interests lie in theoretical computer science, with a focus on quantum complexity theory and quantum algorithms. My work centers on two main themes:

- **The interplay between quantum property testing and complexity theory**, including various settings of quantum state testing (both computational hardness and algorithmic aspects), the computational power of the classes QSZK and BQL, and the design of new quantum algorithms that are efficient in terms of time or space.
- **Quantum computation with limited resources, especially the role of randomness**. Specifically, the impact of intermediate measurements in different contexts related to quantum logspace (e.g., space-bounded quantum interactive proofs), and the computational power of the class StocMA, with connections to derandomization and PCP.

## Education & Employment

- 2022.10– **Ph.D. in Mathematics**, *Nagoya University*, Nagoya, Japan.  
2025.03 Advisor: François Le Gall  
(Expected) Ph.D. Thesis: *Complexity-theoretic perspectives on quantum state testing*
- 2020.07– **Ph.D. in Computer Science (Discontinued)**, *Hebrew University*, Jerusalem, Israel.  
2020.12 Advisor: Dorit Aharonov
- 2017.10– **M.Sc. in Computer Science**, *Hebrew University*, Jerusalem, Israel.  
2020.03 Advisors: Dorit Aharonov and Itai Arad (Technion)  
Overall GPA: 93.22  
M.Sc. Thesis: *Towards a quantum-inspired proof for  $IP = PSPACE$*
- 2013.09– **B.Eng. in Computer Science and Technology**, *Zhejiang University*, Hangzhou, China.  
2017.07 Overall GPA: 85.28, Major (last-two-year) GPA: 88.22  
Senior Project Advisor: Xin Wan (Department of Physics)

## Academic Visits & Internships

- 2022.04– **(Remote) Visiting Student**, *Graduate School of Mathematics*, Nagoya University, Nagoya,  
2022.08 Japan.  
Advisor: François Le Gall
- 2021.03– **(Remote) Visiting Student**, *Centre for Quantum Software and Information*, University  
2021.08 of Technology Sydney, Sydney, Australia.  
Advisor: Zhengfeng Ji
- 2020.04– **Research Assistant**, *School of Computer Science and Engineering*, Hebrew University,  
2020.12 Jerusalem, Israel.  
Advisor: Dorit Aharonov
- Summer 2019 **Research Internship**, *Centre for Quantum Technologies*, National University of Singapore.  
Advisors: Itai Arad (Technion) and Miklos Santha

Summer 2016 **Research Internship**, *Centre for Quantum Technologies*, National University of Singapore.  
Advisors: Itai Arad and Miklos Santha

## Publications & Preprints

(Authors of papers in theoretical computer science are listed *alphabetically*. )

■ Conference Proceedings ■ Conference without Proceedings ■ Journal

- ◇ Space-bounded quantum interactive proof systems  
François Le Gall, **Yupan Liu**, Harumichi Nishimura, and Qisheng Wang  
**QIP 2025**. arXiv:2410.23958
- ◇ On estimating the trace of quantum state powers  
**Yupan Liu** and Qisheng Wang  
**SODA 2025**. **QIP 2025**. arXiv:2410.13559
- ◇ Space-bounded quantum state testing via space-efficient quantum singular value transformation  
François Le Gall, **Yupan Liu**, and Qisheng Wang  
*In submission*. arXiv:2308.05079
- ◇ Quantum state testing beyond the polarizing regime and quantum triangular discrimination  
**Yupan Liu**  
*In submission*. arXiv:2303.01952
- ◇ Quantum Merlin-Arthur proof systems for synthesizing quantum states  
Hugo Delavenne, François Le Gall, **Yupan Liu**, and Masayuki Miyamoto  
To appear in **Quantum**. arXiv:2303.01877
- ◇ StoqMA meets distribution testing  
**Yupan Liu**  
**TQC 2021**. arXiv:2011.05733
- ◇ StoqMA vs. MA: the power of error reduction  
Dorit Aharonov, Alex B. Grilo, and **Yupan Liu**  
To appear in **Quantum**. arXiv:2010.02835
- ◇ Towards a quantum-inspired proof for  $IP = PSPACE$   
Ayal Green, Guy Kindler, and **Yupan Liu**  
**Quantum Information & Computation**. arXiv:1912.11611

## Seminar & Conference Talks

■ Conference Proceedings ■ Conference without Proceedings ■ Workshop

- ◇ **Space-bounded quantum interactive proof systems**  
CS Theory Seminar, Penn State University. Jan. 22nd, 2025  
CS Theory Student Seminar, Columbia University. Oct. 16th, 2024  
**QIP 2025**. Feb 25th, 2025
- ◇ **On estimating the trace of quantum state powers**  
School of Engineering and Applied Sciences, Harvard University. Oct. 10th, 2024  
Department of Mathematics, Ohio State University (Online). Oct. 8th, 2024  
**SODA 2025**. Jan 12th, 2025

- ◇ **Space-bounded quantum state testing via space-efficient quantum singular value transformation**  
 Quantum Information Theory Seminar, University of Bristol. Mar. 6th, 2024  
 Algorithm and Complexity Seminar, University of Cambridge. Feb. 26th, 2024  
 CS Seminar, Centre for Quantum Technologies, Singapore (Online). Nov. 20th, 2023  
 QuSoft Seminar (Online). Sept. 22nd, 2023  
 Research Center for Quantum Software, Tsinghua University. Aug. 9th, 2023  
**Shenzhen-Nagoya Workshop on Quantum Science 2024**. Sept. 19th, 2024
- ◇ **Quantum state testing beyond the polarizing regime and quantum triangular discrimination**  
**LA Symposium 2023 in Summer**. July 4th, 2023
- ◇ **StoqMA meets distribution testing**  
 Department of Computer Science and Technology, Nanjing University. Dec. 9th, 2020  
**AMSS-UTS Joint Workshop on Quantum Computing** (Online). Dec. 16th, 2020  
**TQC 2021**. July 7th, 2021
- ◇ **The untold story of StoqMA**  
 University College London (Online). Dec. 3rd, 2020  
 Yukawa Institute for Theoretical Physics, Kyoto University (Online). Nov. 30th, 2020
- ◇ **Towards a quantum-inspired proof for  $IP = PSPACE$**   
 NTT Basic Research Laboratories. Oct. 18th, 2019  
 Yukawa Institute for Theoretical Physics, Kyoto University. Oct. 15th, 2019
- ◇ **An Invitation to Stoquastic Hamiltonian Complexity**  
 University of Science and Technology of China. Oct. 8th, 2019

## Professional Services

Reviewer FOCS (2024, 2023, 2020), STOC (2025, 2024, 2023), CCC (2024), SODA (2025, 2024, 2022), ITCS (2024), ICALP (2024×2), ESA (2024); QIP (2025×4, 2024×3, 2023, 2022×2, 2021), TQC (2024, 2022, 2020×2), AQIS (2023); SIAM Journal on Computing, Nature Physics, Theory of Computing Systems, Quantum Journal.

## Academic Honors & Awards

**Nagoya University Interdisciplinary Frontier Fellowship**, Nagoya University.  
 2023.04 - 2025.03

## Teaching Experience

Fall 2019 **Kazhdan's Lecture: Computation, quantumness, symplectic geometry, information**, Hebrew University, Jerusalem, Israel.  
 Instructors: Gil Kalai, Leonid Polterovich, Dorit Aharonov, Guy Kindler  
 Scribed notes for all computer science oriented lectures (half of the course).