

Peixue Wu

Assistant Professor

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Employment

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- 08/2026–present** **Assistant Professor (tenure-track)**, Department of Mathematics, Institute for Quantum and Information Sciences, Syracuse University.
- 09/2023–08/2026** **Postdoctoral Fellow**, Institute for Quantum Computing, University of Waterloo. Mentor: Professor Graeme Smith.
- 05/2022–08/2022** **Research Scientist Intern**, Amazon Web Services Center for Quantum Computing, Pasadena, California.

Education

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- 08/2017–08/2023** **Ph.D. in Mathematics**, University of Illinois at Urbana-Champaign.
Advisors: Professors Renming Song and Marius Junge.
Dissertation: *Dynamical approach in quantum information theory*.
- 09/2013–07/2017** **B.S. in Mathematics**, Fudan University, Shanghai, China.

Research Interests

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- Quantum information theory and quantum Shannon theory: quantum channel capacities, privacy, entropic inequalities, additivity and nonadditivity, and entanglement distillation.
 - Operator algebras and noncommutative analysis: quantum optimal transport, von Neumann algebras, free probability, and noncommutative geometric methods.
 - Open quantum systems and quantum simulation: quantum Markov semigroups, mixing, stability, and lower bounds on simulation complexity.
 - Quantum tomography, quantum sensing, and probability and stochastic-process methods in quantum information.

Honors and Research Support

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- 2026** **Simons Empire Faculty Fellow in Mathematics**, Simons Foundation International.
- 2023–2025** **Canada First Research Excellence Fund**, University of Waterloo; postdoctoral research support.
- 2022–2023** **Campus Research Board**, University of Illinois at Urbana-Champaign; one-year research support.

Publications

Authors are listed alphabetically unless marked with an asterisk ().*

Journal Articles

8. **Transportation cost and contraction coefficient for channels on von Neumann algebras.**
Joint with Roy Araiza and Marius Junge.
Journal of Functional Analysis, to appear; [arXiv:2506.04197](https://arxiv.org/abs/2506.04197).
7. **Resource-Dependent Complexity of Quantum Channels.**
Joint with Roy Araiza, Yidong Chen, and Marius Junge.
Quantum **10**, 1960 (2026); [arXiv:2303.11304](https://arxiv.org/abs/2303.11304).
6. **Reverse-type Data Processing Inequality.**

Joint with Paula Belzig, Li Gao, and Graeme Smith.

Communications in Mathematical Physics **406**, 295 (2025); [arXiv:2411.19890](#).

5. **Additivity of quantum capacities in simple non-degradable quantum channels.**

Joint with Graeme Smith.

IEEE Transactions on Information Theory **71**(8), 6134–6154 (2025); [arXiv:2409.03927](#).

4. **Lower bound for simulation cost of open quantum systems: Lipschitz continuity approach.**

Joint with Zhiyan Ding, Marius Junge, and Philipp Schleich.

Communications in Mathematical Physics **406**, 60 (2025); [arXiv:2407.15357](#).

3. **Heat kernel estimates for regional fractional Laplacians with multi-singular critical potentials in $C^{1,\beta}$ open sets.**

Joint with Renming Song and Shukun Wu.

Stochastic Processes and their Applications **189**, 104727 (2025); [arXiv:2203.03891](#).

2. **A note on the stabilizer formalism via noncommutative graphs.**

Joint with Roy Araiza, Jihong Cai, Yushan Chen, Abraham Holtermann, Chieh Hsu, Tushar Mohan, and Zeyuan Yu.

Quantum Information Processing **23**, 84 (2024); [arXiv:2310.00762](#).

1. ***Time fractional stochastic differential equations driven by pure jump Lévy noise.**

Joint with Zhiwei Yang, Hong Wang, and Renming Song.

Journal of Mathematical Analysis and Applications **503**, 125412 (2021); [arXiv:2009.06866](#).

Refereed Conference Proceedings

3. ***Quantum f -divergences and Their Local Behaviour: An Analysis via Relative Expansion Coefficients.**

Joint with Shreyas Iyer, Paula Belzig, and Graeme Smith.

Forthcoming in the *Proceedings of the 2026 IEEE International Symposium on Information Theory (ISIT 2026)*; [arXiv:2510.06183](#).

2. ***Quantum capacity amplification via privacy.**

Joint with Yunkai Wang.

In the *Proceedings of the 2025 IEEE International Symposium on Information Theory (ISIT 2025)*, pp. 1976–1981; extended version: [arXiv:2510.04527](#).

1. ***Quantum Secret Sharing and Tripartite Information.**

Joint with Guangkuo Liu, Marius Junge, and Chloe Kim.

In the *Proceedings of the 2023 IEEE International Symposium on Information Theory (ISIT 2023)*, pp. 1931–1936; [arXiv:2012.08445](#).

Preprints

6. ***Private Correlations Certify Sensing Capability.**

Joint with Yunkai Wang, Graeme Smith, and Sisi Zhou.

Preprint, August 2026; [arXiv:2608.10377](#).

5. **Counterexamples to additivity of minimum output p -Rényi entropy of quantum channels for $p > 3/4$ and $0 \leq p < 1/4$.**

Joint with Debbie Leung and Benjamin Lovitz.

Preprint, July 2026; [arXiv:2607.15210](#).

4. **The Optimal Rate Function in Covariant Quantum State Tomography.**

Joint with Arick Grootveld, Alexander Maloney, and Jason Pollack.

Preprint, June 2026; [arXiv:2606.16948](#).

3. **Single-letter one-way distillable entanglement for non-degradable states.**

Joint with Rabsan Galib Ahmed and Graeme Smith.

Preprint, March 2026; [arXiv:2603.23417](https://arxiv.org/abs/2603.23417).

2. ***Probing the Critical Point (CritPt) of AI Reasoning: a Frontier Physics Research Benchmark.**

Joint with Minhui Zhu et al.

Preprint, September 2025; [arXiv:2509.26574](https://arxiv.org/abs/2509.26574).

1. **Stability property for the quantum jump operators of an open system.**

Joint with Marius Junge.

In revision; [arXiv:2211.07527](https://arxiv.org/abs/2211.07527).

Research Talks

- **Projection-induced channels and additivity violation of minimum output entropy**, *Additivity Problems in Quantum and Classical Information Theory*, Banff International Research Station, Banff, Alberta, July 2026. Invited talk.
- **Quantum Optimal Transport: Bridging Mathematical Foundations and Quantum Information Science**, Mathematics Colloquium, Syracuse University, February 2026. Invited talk.
- **Quantum capacity amplification via privacy**, IEEE International Symposium on Information Theory (ISIT 2025), Ann Arbor, Michigan, June 2025.
- **Additivity of quantum capacities in simple non-degradable quantum channels**, IEEE International Symposium on Information Theory (ISIT 2025), Ann Arbor, Michigan, June 2025.
- **Transportation cost and contraction coefficient for channels on von Neumann algebras**, *Operator Algebra and Quantum Information*, University of Waterloo, June 2025.
- **From noncommutative optimal transport to limitations of quantum simulation**, Noncommutative Optimal Transport Workshop II, UCLA/IPAM, April 2025.
- **Lower bound for simulation cost of open quantum systems**, 28th Annual Quantum Information Processing Conference (QIP 2025), Raleigh, North Carolina, February 2025.
- **Additivity of quantum capacities in simple non-degradable quantum channels**, IQC Math and Computer Science Seminar, University of Waterloo, January 2025.
- **Reverse-type data processing inequality**, University of Illinois Urbana-Champaign, November 2024.
- **Lower bound for gate complexity via quantum optimal transport**, University of California, Berkeley, November 2024.
- **Lower bound for simulation cost of quantum Markov semigroups**, Wuhan University, September 2024.
- **Additivity of quantum capacities in simple non-degradable quantum channels**, Beyond IID 2024, University of Illinois Urbana-Champaign, August 2024.
- **Resource-Dependent Complexity of Quantum Channels**, Harbin Institute of Technology, November 2023.
- **Resource-Dependent Complexity of Quantum Channels**, Beyond IID 2023, University of Tübingen, August 2023.
- **Stability property of open quantum systems**, Michigan State University, March 2023.
- **Heat kernel estimates for non-local operators with multi-singular killing potential**, University of Wisconsin–Madison Conference, September 2022.
- **Aspects of large deviation theory for open quantum systems**, Operator Algebra Seminar, University of Illinois Urbana-Champaign, May 2022.
- **Stability property of open quantum systems**, World Quantum Days, University of Illinois Physics, April 2022.
- **Stability of complete entropic inequalities for quantum Markov semigroups**, AMS Spring Central Sectional Meeting, March 2022.

- **Heat kernel estimates for non-local operators with multi-singular killing potential**, Non-local Operators Workshop, February 2022.
- **Heat kernel estimates for non-local operators with multi-singular killing potential**, Frontier Probability Days, November 2021.
- **Intrinsic probability for quantum Markov semigroups**, Probability Seminar, University of Illinois Urbana-Champaign, March 2021.
- **Quantum Secret Sharing and Tripartite Information**, Operator Algebra Seminar, University of Illinois Urbana-Champaign, January 2021.

Teaching Experience

Syracuse University

- **MAT 331: First Course in Linear Algebra**, Fall 2026.

University of Waterloo

- **MATH 237: Calculus 3 for Honours Mathematics**, Summer 2024 — Instructor of record; 146 students.

University of Illinois at Urbana-Champaign

- **MATH 220/231/241: Calculus I–III**, Fall 2020, Spring and Fall 2021, and Spring 2022 — Discussion instructor.
- **MATH 461: Probability Theory**, Spring 2018, Fall 2019, and Spring 2020 — Led problem sessions and graded coursework.

Professional Skills

- **Programming:** Python, MATLAB, R, C/C++.
- **Languages:** Mandarin Chinese (native), English (fluent).

Last updated: August 2026