

Junseo Lee

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EDUCATION

Harvard University, Kenneth C. Griffin Graduate School of Arts and Sciences Doctor of Philosophy (Ph.D.) in Quantum Science and Engineering • Advisors: Anurag Anshu and Sitan Chen (Computer Science); Jordan Cotler (Physics) • Affiliations: Harvard Quantum Initiative; Theory of Computation Group	CAMBRIDGE, MA, USA (Starting in Fall 2026)
Massachusetts Institute of Technology (MIT) Cross-Registered Graduate Student	CAMBRIDGE, MA, USA (Starting in Fall 2026)
Yonsei University Bachelor of Science (B.S.) in Electrical and Electronic Engineering • Fully funded by the Hyundai Motor CMK Science and Technology Scholarship • Thesis: <i>Combinatorial Designs in Information Theory</i> (Advisor: Hong-Yeop Song)	SEOUL, KOREA (Mar. 2019 – Feb. 2023)
Chungnam Science High School Concentration in Mathematics; Early Honors Graduate	GONGJU, KOREA (Mar. 2017 – Dec. 2018)

RESEARCH EXPERIENCE

Seoul National University (SNU) Research Associate (<i>Institute of Computer Technology</i> , Host: Kabgyun Jeong) Research Affiliate (<i>Research Institute of Mathematics</i> , Host: Kabgyun Jeong) Undergraduate Research Assistant (<i>Research Institute of Mathematics</i> , Advisor: Kabgyun Jeong)	SEOUL, KOREA (Apr. 2026 – Aug. 2026) (Jan. 2023 – Mar. 2026) (Mar. 2020 – Dec. 2022)
Republic of Korea Army Research Scientist (<i>Technical Research Personnel, Mandatory Military Service</i>)	SEOUL, KOREA (Mar. 2023 – Mar. 2026)
Yonsei University Undergraduate Research Assistant (<i>High Dimensional Signal Processing Lab</i> , Advisor: Chulhee Lee) Undergraduate Research Assistant (<i>Mathematical Biology Lab</i> , Advisor: Jeehyun Lee)	SEOUL, KOREA (Jul. 2022 – Dec. 2022) (Dec. 2021 – Feb. 2022)
Korea Advanced Institute of Science and Technology (KAIST) Pre-Undergraduate Student Researcher (<i>Atomic-Scale Device Simulation Lab</i> , Advisor: Yong-Hoon Kim) Pre-Undergraduate Student Researcher (<i>Therapeutic Biomaterials Engineering Lab</i> , Advisor: Ji-Ho Park)	DAEJEON, KOREA (Summer 2018) (Summer 2017)

PUBLICATIONS ([Google Scholar Profile](#))

*Equal contribution. †Authors listed alphabetically.

- (16) Myeongjin Shin, **Junseo Lee**, and Changhun Oh, “Heisenberg-limited Hamiltonian learning without short-time control,” (2026). [arXiv:2604.27838](https://arxiv.org/abs/2604.27838).
- (15) Andreas Bluhm, Matthias C. Caro, Francisco Escudero Gutiérrez, **Junseo Lee**[†], Aadil Oufkir, Cambyse Rouzé, and Myeongjin Shin, “Certifying and learning local quantum Hamiltonians,” (2026). In: *21st Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC 2026, Contributed talk)*. [arXiv:2603.29809](https://arxiv.org/abs/2603.29809).
- (14) Marco Fanizza, Vishnu Iyer, **Junseo Lee**[†], Antonio Anna Mele, and Francesco Anna Mele, “Efficient learning of bosonic Gaussian unitaries,” (2025). In: *29th Annual Conference on Quantum Information Processing (QIP 2026, Contributed talk)*. [arXiv:2510.05531](https://arxiv.org/abs/2510.05531).
- (13) Donghwa Ji, **Junseo Lee**, Myeongjin Shin, IlKwon Sohn, and Kabgyun Jeong, “Bounding quantum uncommon information with quantum neural estimators,” *Quantum Science and Technology* **11**, 015001 (2026). DOI: [10.1088/2058-9565/ae18f4](https://doi.org/10.1088/2058-9565/ae18f4).

- (12) Kartik Anand, Kabgyun Jeong, and **Junseo Lee**[†], “Collapses in quantum-classical probabilistically checkable proofs and the quantum polynomial hierarchy,” (2025). arXiv:2506.19792.
- (11) Myeongjin Shin*, **Junseo Lee***, Seungwoo Lee, and Kabgyun Jeong, “Resource-efficient algorithm for estimating the trace of quantum state powers,” *Quantum* **9**, 1832 (2025). doi: 10.22331/q-2025-08-27-1832.
- (10) Mingyu Lee, Myeongjin Shin, **Junseo Lee**, and Kabgyun Jeong, “Mutual information maximizing quantum generative adversarial networks,” *Scientific Reports* **15**, 32835 (2025). doi: 10.1038/s41598-025-18476-y.
- (9) Myeongjin Shin*, Seungwoo Lee*, **Junseo Lee***, Donghwa Ji, Hyeonjun Yeo, and Kabgyun Jeong, “Disentanglement provides a unified estimation for quantum entropies and distance measures,” *Physical Review A* **110**, 062418 (2024). doi: 10.1103/PhysRevA.110.062418.
- (8) Myeongjin Shin, **Junseo Lee**, and Kabgyun Jeong, “Estimating quantum mutual information through a quantum neural network,” *Quantum Information Processing* **23**, 57 (2024). doi: 10.1007/s11128-023-04253-1.
- (7) **Junseo Lee** and Kabgyun Jeong, “Quantum Rényi entropy functionals for bosonic gaussian systems,” *Physics Letters A* **490**, 129183 (2023). doi: 10.1016/j.physleta.2023.129183
- (6) **Junseo Lee**, Hyeonjun Yeo, and Kabgyun Jeong, “Weighted p -Rényi entropy power inequality: Information theory to quantum Shannon theory,” *International Journal of Theoretical Physics* **62**, 253 (2023). doi: 10.1007/s10773-023-05512-8
- (5) **Junseo Lee** and Kabgyun Jeong, “High-dimensional private quantum channels and regular polytopes,” *Communications in Physics* **31**, 189 (2021). doi: 10.15625/0868-3166/15762
- (4) Kabgyun Jeong, **Junseo Lee**, *et al.*, “Single qubit private quantum channels and 3-dimensional regular polyhedra,” *New Physics: Sae Mulli* **68**, 232 (2018). doi: 10.3938/NPSM.68.232

Book Chapters

- (3) **Junseo Lee**, “Assessing Quantum Integer Factorization Performance with Shor’s Algorithm,”
In: *Quantum Computing: A Journey into the Next Frontier of Information and Communication Security*,
Edited by Mohammad Hammoudeh, Abdullah T. Alessa, Amro M. Sherbeeni, Clinton M. Firth, Abdullah S. Alessa,
CRC Press (2024). doi: 10.1201/9781003475286

Patents

- (2) Kabgyun Jeong, Myeongjin Shin, and **Junseo Lee**, “Method for estimating quantum mutual information through a quantum neural network,” *Korea Patent Open No. 10-2026-0009068* (2024). doi: 10.8080/1020240091151

Notes

- (1) **Junseo Lee**[†] and Myeongjin Shin, “Optimal certification of constant-local Hamiltonians,” (2025).
arXiv:2512.09778. (This note has been subsumed by a subsequent work; see arXiv:2603.29809 for details.)

PROFESSIONAL ACTIVITIES

Journal Reviewer

Physical Review Letters, PRX Quantum, Physical Review Research, Physical Review Applied, Physical Review A, npj Quantum Information, IEEE Transactions on Information Theory, Quantum, Physics Letters A, Annalen der Physik

Conference Reviewer

- *IEEE Symposium on Foundations of Computer Science (FOCS)*, 2026
- *Theory of Quantum Computation, Communication and Cryptography (TQC)*, 2026
- *Quantum Computing Theory in Practice (QCTiP)*, 2026
- *Quantum Techniques in Machine Learning (QTML)*, 2025

Organizing

- Organizer, *QISCA Winter School on Quantum Learning Theory for Bosonic and Fermionic Systems*, 2026

- Co-organizer, *SNU Quantum Information Theory Seminar*, 2024–2025
- Co-organizer, *Quantum AI Hackathon* (jointly organized by Kakao Enterprise and Jeonju University), 2025

Committee and Reviewing

- Poster Session Judge, *National Undergraduate Quantum Conference*, Seoul National University, 2026
- Selection Committee Member, *Quantum Internship Program* (National Information Society Agency; Korea Quantum Industry Center), 2024–2025

Outreach and Community Resources

- Creator and Maintainer, *Quantum Learning Theory Zoo*, 2025–present
- Facilitator (Mentor), *Korea Scholar's Conference for Youth (KSCY)*, Yonsei University, 2019

SELECTED HONORS AND AWARDS

Funding and Fellowships

- *Graduate Fellowship*, Harvard University, 2026
- *Academic Travel Grant*, Hyundai Motor CMK Foundation, 2022
- *Hyundai Motor CMK Science and Technology Scholarship*, 2021–2022
- *Teaching Fellow (Software Courses)*, Yonsei University, 2021–2022

Academic Excellence

- *High Honors*, Yonsei University, 2022
- *Honors*, Yonsei University, 2020–2021
- *Science Scholarship*, JH Foundation, 2017
- *Academic Excellence Scholarship*, Asan Future Scholarship Foundation, 2016

Additional Honors and Awards

- *Selected Paper Award*, Finance and Economics Contest (DB Group), 2022
- *Best Tutor Award*, Yonsei University, 2021–2022
- *Third Prize*, Undergraduate Research Exhibition, Korean Physical Society, 2021
- *Bronze Award*, Humantech Paper Award (Samsung Electronics), 2018
- *Best Translator Award*, NAVER Connect Foundation & Khan Academy, 2018
- *Pre-Undergraduate Research Fellow*, Korea Advanced Institute of Science and Technology, 2017–2018
- *Honorable Mention (National) & Gold Award (Regional)*, Korean Olympiad in Informatics, 2016

RESEARCH VISITS

- Harvard University (funded by Anurag Anshu and the Harvard Quantum Initiative), Mar. 2026

TEACHING

Undergraduate Research Mentoring

(Mentored undergraduate students during my Research Associate appointment at Seoul National University)

- Arul Rhik Mazumder, Carnegie Mellon University, 2026–present
- Kartik Anand, Indian Institute of Technology Goa, [*arXiv '25*], 2025
- Donghwa Ji, Seoul National University, [*Quantum Sci. Technol. '26*], 2025–present (co-supervised with Kabgyun Jeong)
- Mingyu Lee, Seoul National University (Research Intern at University of Oxford), [*Sci. Rep. '25*], 2024–present (co-supervised with Sathyawageeswar Subramanian and Kabgyun Jeong)
- Myeongjin Shin, Korea Advanced Institute of Science and Technology, [*PRA '24, Quantum '25, TQC '26*], 2023–present (co-supervised with Kabgyun Jeong)

Quantum Information Science Club Association(Teaching materials available at: harris-junseo-lee.github.io/teaching/)

- Organizer and Lecturer, *Quantum Learning Theory for Bosonic and Fermionic Systems*, Lecture 6: “Learning Bosonic Gaussian Unitaries,” Winter 2026
- Invited Lecturer, *Quantum Complexity Reading Group*, Fall 2025
- Invited Lecturer, *Quantum Learning and Complexity Theory*, Summer 2025

University–Industry Research Internship

- Instructor, AAA559: *College of Informatics Internship (II) (Graduate Course)*, Korea University, Fall 2025
- Instructor, AAA558: *College of Informatics Internship (I) (Graduate Course)*, Korea University, Fall 2025
- Instructor, SW4343: *Software Field Placement (I)*, Korea Aerospace University, Fall 2024

Yonsei University

- Teaching Assistant, YCS1009: *Change the World through Programming*, Fall 2022
- Teaching Assistant, YCS1002: *Software Programming*, Fall 2022
- Teaching Assistant, EEE1108: *Engineering Information Processing*, Fall 2021
- Course Tutor, MAT2016: *Engineering Mathematics (III)*, Spring 2022 (Best Tutor Award)
- Course Tutor, MAT1012: *Engineering Mathematics (II)*, Fall 2021 (Best Tutor Award)

SELECTED TALKS

* Online talk.

Research Talks

“Certifying and learning local quantum Hamiltonians”

- Contributed talk, *21st Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC 2026)*, Sep. 2026

“Optimal certification of constant-local Hamiltonians”

- Invited talk, *Quantum Software Lab Seminar*, University of Edinburgh, Mar. 2026*
- Contributed talk, *Annual Meeting of the Quantum Information Society of Korea (QISK 2026)*, Feb. 2026

“Efficient learning of bosonic Gaussian unitaries”

- Invited talk, *Annual Meeting of the Quantum Information Society of Korea (QISK 2026)*, Feb. 2026
- Invited talk, *N³etFraST Workshop*, Nov. 2025
- Invited talk, *Quantum Data Science & AI Lab Seminar*, Yonsei University, Nov. 2025
- Contributed talk, *29th Annual Conference on Quantum Information Processing (QIP 2026)*, Jan. 2026 (presented under the title “Efficient Learning Algorithms for Structured Bosonic and Fermionic Unitary Operators”)

“Resource-efficient algorithm for estimating the trace of quantum state powers”

- Invited talk, *Electronics & Telecommunications Research Institute (ETRI)*, Dec. 2024
- Invited talk, *Quantum Information Theory Seminar*, SNU, Dec. 2024*
- Invited talk, *IBM-Yonsei Qiskit Fall Fest*, Yonsei University, Nov. 2024*
- Contributed talk, *Annual Meeting of the Korean Mathematical Society (KMS)*, Oct. 2024
- Poster, *28th Annual Conference on Quantum Information Processing (QIP 2025)*, Feb. 2025

“Mutual information maximizing quantum generative adversarial network”

- Invited talk, *Triangle Quantum Computing Seminar*, NC State University Quantum Initiative, Nov. 2023*

“Estimating quantum mutual information through a quantum neural network”

- Invited talk, *CS Katha Barta*, National Institute of Science Education and Research Bhubaneswar, Aug. 2023*

“Quantum Rényi entropy functionals for bosonic Gaussian systems”

- Poster, *25th Annual Conference on Quantum Information Processing (QIP 2022)*, Mar. 2022

“High-dimensional private quantum channels and regular polytopes”

- Invited talk, *KISTI-KU-SNU Joint Workshop*, Sep. 2023*
- Invited talk, *Quantum Information Theory Seminar*, SNU, Aug. 2021*
- Contributed talk, *Winter Meeting of the Optical Society of Korea (OSK)*, Feb. 2022
- Contributed talk, *Fall Meeting of the Korean Physical Society (KPS)*, Oct. 2021*
- Poster, *25th Annual Conference on Quantum Information Processing (QIP 2022)*, Mar. 2022

Tutorials and Public Lectures

“Getting Started in Quantum Information Science”

- Invited talk, *Student Outreach Lecture*, Shinil High School, Aug. 2026

“Learning theory in ∞ -dimensional quantum systems”

- Invited talk, *Team QST Summer Workshop*, SNU, Aug. 2025

“Introduction to quantum machine learning”

- Invited talk, *Healthcare & Research Team Seminar*, Amazon Web Services (AWS) Korea, Mar. 2025

“Topics in theoretical quantum computer science”

- Invited talk, *Student Outreach Lecture*, Shinil High School, Aug. 2024

“Quantum machine learning models for drug library generation”

- Invited talk, *Quantum Computing and Monte Carlo Workshop*, Yonsei University, Aug. 2024

“QMA $\stackrel{?}{\stackrel{?}{\equiv}}$ NP: The NLTS theorem and the quantum PCP conjecture”

- Invited talk, *Center for Quantum Network’s Channel Capacity Summer Workshop*, SNU, Jul. 2024

“Minimal data may be sufficient for quantum artificial intelligence”

- Invited talk, *Department of Mathematical Sciences Seminar*, SNU, Jun. 2023*