

Unit Name

Quantum Information Science and Technology Unit

Collaborations

Marcus Huber, Technische Universität Wien, Austria, Ticking phenomena in quantum systems

Gerard Milburn, University of Sussex, UK, Quantum optics, quantum measurement and control, quantum computation and information, and quantum machine learning

Michael Trupke, University of Vienna, Austria, Quantum device with lattice defects

Jörg Schmiedmayer, Technische Universität Wien, Austria, Quantum collective effects with ensemble spins

Michael Hanks, Blackett Laboratory, Imperial College London, UK, Faulty States can be used in Cat Code Error Correction

Ming Gong et. al., University of Science and Technology of China, China, Experimental demonstration of a Maxwell's demon quantum battery in a superconducting noisy intermediate-scale quantum processor

Franco Nori, RIKEN, Japan, Efficient charging of multiple open quantum batteries through dissipation and pumping

Timothy C. Ralph, University of Queensland, Australia, Efficient charging of multiple open quantum batteries through dissipation and pumping

Research Personnel

Member

Kae Nemoto, Professor

Nicolo Lo Piparo, Staff Scientist

Josephine Dias, Postdoctoral Scholar

Thomas Scruby, Postdoctoral Scholar

Akitada Sakurai, Postdoctoral Scholar

Henry Nourse, Postdoctoral Scholar

Hon Wai Lau, Postdoctoral Scholar

Nicholas Connolly, Postdoctoral Scholar

Chaimae El Bouazizi, Research Unit Technician

Peizhe Li, Special Research Student

Shin Nishio, Special Research Student

Aoi Hayashi, Special Research Student

Thesis Supervising

Chowdhury Sougato

Co-supervising

Iakovleva Tatiana

Ryzov Ilia

Mentoring

Raj Aswathy

Jose Amal

Hosting Rotation Students

Ryzov Ilia

Grant Kyle Stanley

Kawai Hideaki

Research Intern

Eddie Daniel Kelly

Scholarly Contributions and Creative Productions (by Faculty)

Conference Proceedings

1. Pei-Zhe Li, Josephine Dias, William J. Munro, Peter van Loock, Kae Nemoto, Nicolo Lo Piparo, Quantum Network Utilizing Multiple Channels Based on Cavity-QED and Continuous-Variable Codes, In Technical Digest Series (Optica Publishing Group, 2024); Vol. JW2A.130, p JW2A.130, 2024
https://opg.optica.org/abstract.cfm?URI=CLEO_AT-2024-JW2A.130
2. William J. Munro, Akitada Sakurai, Aoi Hayashi, Kae Nemoto, Photonic Quantum Extreme Reservoir Computation, In Technical Digest Series; Optica Publishing Group, Vol. FM2K.2, p FM2K.2, 2024
https://doi.org/10.1364/CLEO_FS.2024.FM2K.2
3. Kae Nemoto, Akitada Sakurai, Aoi Hayashi, William J. Munro, Photonic Quantum Extreme Reservoir Computation, In Proceedings : Quantum Communications and Quantum Imaging XXII, Vol. PC13148, p PC1314807, 2024
<https://doi.org/10.1117/12.3026065>
4. William J. Munro, Nicolo Lo Piparo, Kae Nemoto, Quantum Multiplexing and Aggregation in Quantum Networking. In Proceedings, Quantum Communications and Quantum Imaging XXII, Vol. PC13148, p PC1314807, 2024
<http://doi.org/10.1117/12.3026065>
5. William J. Munro, Akitada Sakurai, Aoi Hayashi, and Kae Nemoto, Boson sampling powered image recognition, Proc. SPIE PC13391, Quantum Computing, Communication, and Simulation V, PC133910N, 2025
<https://doi.org/10.1117/12.3038939>

Journal Article

1. Pei-Zhe Li, Josephine Dias, William J. Munro, Peter van Loock, Kae Nemoto,

Performance of Rotation-Symmetric Bosonic Codes in a Quantum Repeater Network, Advance Quantum Technologies 2024, 2300252 (11 pages) 2024

<https://doi.org/10.1002/qute.202300252>

2. Hiroo Azuma, William J. Munro, and Kae Nemoto,
Heralded Single-Photon Source Based on Superpositions of Squeezed States, Physical Review A, 109, 053711 (8 pages) 2024
<http://doi.org/10.1103/PhysRevA.109.053711>
3. Jiale Yu, Shiyu Wang, Kangqiao Liu, Chen Zha, Yulin Wu, Fusheng Chen, Yangsen Ye, Shaowei Li, Qingling Zhu, Shaojun Guo, Haoran Qian, He-Liang Huang, Youwei Zhao, Chong Ying, Daojin Fan, Dachao Wu, Hong Su, Hui Deng, Hao Rong, Kaili Zhang, Sirui Cao, Jin Lin, Yu Xu, Cheng Guo, Na Li, Futian Liang, Gang Wu, Yong-Heng Huo, Chao-Yang Lu, Cheng-Zhi Peng, Kae Nemoto, W. J. Munro, Xiaobo Zhu, Jian-Wei Pan, Ming Gong,
Experimental Demonstration of a Maxwell's Demon Quantum Battery in a Superconducting Noisy Intermediate-Scale Quantum Processor, Physical Review A, 109, 062614 (26 pages) 2024
<http://doi.org/10.1103/PhysRevA.109.062614>
4. Nicolò Lo Piparo, William J. Munro, Kae Nemoto,
Quantum Aggregation with Temporal Delay, Physical Review A, 110, 032613 (9 pages) 2024
<http://doi.org/10.1103/PhysRevA.110.032613>
5. Shin Nishio, Nicholas Connolly, Nicolò Lo Piparo, William John Munro, Thomas Rowan Scruby, Kae Nemoto,
Multiplexed Quantum Communication with Surface and Hypergraph Product Codes, Quantum, 9, 1613 (29 pages) 2025
<http://doi.org/10.22331/q-2025-01-28-1613>
6. Aoi Hayashi, Akitada Sakurai, William J. Munro, and Kae Nemoto,
Effective Quantum Feature Maps in Quantum Extreme Reservoir Computation from the XY Mode, Physical Review A, 111, 022431(11 pages) 2025
<https://doi.org/10.1103/PhysRevA.111.022431>

Presentation at Conference

1. Kae Nemoto
Quantum Networks: From Devices to Applications, International Conference on Quantum Communications, Networking, and Computing (QCNC 2024), (Kanazawa, Japan) July 1-3, 2024[Invited] [Keynote]
2. Kae Nemoto
Quantum Networks and Edge Computation, 16th Pacific Rim Conference on Lasers and Electro-Optic(CLEO PacificRim) 2024, (Incheon, Korea) August 4–9, 2024[Invited]
3. Kae Nemoto
Photonic quantum extreme reservoir computation, Quantum Communications and Quantum Imaging XXII, SPIE Optics + Photonics, (San Diego, USA) August 18 – 22, 2024[Invited]
4. Kae Nemoto
Quantum Software, International Conference on Solid State Devices and Materials(SSDM)2024, (Himeji, Japan) September 1–4, 2024[Invited]
5. Kae Nemoto
A Fully-Programmable Universal Quantum Simulator Using Floquet Technology, Recent Progress in Many-Body Theories (RPMBT22), (Tsukuba, Japan) September 23–27, 2024[Invited]
6. Kae Nemoto
Quantum Complexity - What Complexity Does Quantum Computer Create and Solve?, Quantum Extreme Universe: Matter, Information, and Gravity, (Okinawa, Japan) October 21-25, 2024[Invited]
7. Kae Nemoto

Quantum Circuit Compilation and Compression, The 35th IEEE International Symposium on Software Reliability Engineering, (Tsukuba, Japan) October 28-31, 2024[Invited]

8. Kae Nemoto

Quantum Computation and Machine Learning, Japanese-German Symposium on Applications of Quantum Computers, (Berlin, Germany) November 11, 2024[Invited]

9. Kae Nemoto

共通的コアプログラム「量子技術高等教育拠点標準プログラムの開発」, 7th Q-LEAP Symposium, (Tokyo, Japan) February 28, 2025[Invited]

Scholarly Contributions (by Unit Members)

Journal Article

1. Mahbub Rahaman, Akitada Sakurai, and Anlabha Roy, Time crystal embodies chimeralike state in periodically driven quantum spin system, New Journal of Physics 26, 063035 (2024)
2. Nicholas Connolly, Vivien Londe, Anthony Leverrier, Nicolas Delfosse, Fast erasure decoder for hypergraph product codes, Quantum 8, 1450 (2024)

Poster Presentation at Conference

1. Peizhe Li, Quantum Network Utilizing Multiple Channels Based on Cavity-QED and Continuous-Variable Codes, Conference on Lasers and Electro-Optic (CLEO) 2024, (Charlotte USA) May 05-10, 2024
2. Aoi Hayash, 量子機械学習における量子ビットの相互作用ネットワークと量子特徴マップの解析, 第 50 回量子情報技術研究会(QIT50) (Tsukuba, Japan) May 28-30, 2024
3. Nicolò Lo Piparo, The Effects of Delay in Aggregated Quantum Networks, 16th Pacific Rim Conference on Lasers and Electro-Optic(CLEO PacificRim) 2024, (Incheon, Korea) August 4-9, 2024
4. Shin Nishio, Multiplexed Quantum Communication with Surface and Hypergraph Product Codes, 24th Asian Quantum Information Science Conference(AQIS) 2024, (Sapporo, Japan) August 26-30, 2024
5. Nicholas Connolly, An Efficient Erasure Decoder and Quantum Multiplexing using Hypergraph Product Codes, 24th Asian Quantum Information Science Conference (AQIS) 2024, (Sapporo, Japan) August 26-30, 2024
6. Chaimae El Bouazizi, Proposing a new integrated model of classical and quantum neural networks, 24th Asian Quantum Information Science Conference (AQIS) 2024, (Sapporo, Japan) August 26-30, 2024
7. Aoi Hayashi, The impact of connectivity in qubit networks and the symmetry in the XY model on the quantum machine learning's performanceRecent Progress in Many-Body Theories (RPMBT22) (Tsukuba, Japan) September 23-27, 2024
8. Nicholas S. Connolly, An efficient erasure decoder and quantum multiplexing using hypergraph product code, Quantum Innovation 2024, (Tokyo, Japan) October 21-23, 2024
9. Hon Wai Lau, Modular quantum extreme reservoir computing, Quantum Innovation 2024, (Tokyo, Japan) October 21-23, 2024
10. Aoi Hayashi, Uncertainty estimation in quantum extreme reservoir computation towards enabling reliable quantum machine learning, 8th international conference on quantum techniques in machine learning (QTML2024) (Melbourne, Australia) November 25-29, 2024
11. Chaimae El Bouazizi, A new approach for the Quantum extreme reservoir computing based on Auto Encoder, 8th international conference on quantum techniques in machine learning (QTML2024) (Melbourne, Australia) November 25-29, 2024

Presentation at Conference

1. Nicolò Lo Piparo, All the advantages of quantum multiplexing, 55th Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics, (Texas, US) June 3-7, 2024
2. Shin Nishio, グラフ理論の問題と量子計算, 新奇デバイス・アーキテクチャの効率的実現のためのソフトウェア、アルゴリズムと(回路)最適化の会(第 5 回), (Tokyo, Japan) July 22, 2024
3. Akitada Sakurai, Simple-Hamiltonian dynamics is a powerful quantum reservoir, Recent Progress in Many-Body Theories (RPMBT22), (Tsukuba, Japan) September 23-27, 2024
4. Hon Wai Lau, Modular quantum extreme reservoir computing, Workshop of Biological, Artificial, and Quantum Intelligence 2025 (BAQ2025), (Okinawa, Japan) March 12 -14, 2025
5. Hon Wai Lau, Modular quantum extreme reservoir computing, 72nd JSAP Spring Meeting 2025, (Tokyo, Japan) March 14-17, 2025

6. Aoi Hayashi, XY ハミルトニアンにおける量子ビットの結合ネットワークが生成する効果的な量子特徴マップの解析, 第 198 回ハイパフォーマンスコンピューティング・第 14 回量子ソフトウェア合同研究発表会, (Hokkaido, Japan) March 17-19, 2025
7. Shin Nishio, Online Job Scheduler for Fault-tolerant Quantum Multiprogramming, 第 198 回ハイパフォーマンスコンピューティング・第 14 回量子ソフトウェア合同研究発表会, (Hokkaido, Japan) March 17-19, 2025

External Service

2024	Specially-appointed Professor at National Institute of Informatics, Principles of Informatics Research Division, National Institute of Informatics (NII)
2024	Deputy Representative Director of Quantum Forum, Quantum Forum
2024	Committee member of Quantum Innovation 2024, Quantum Innovation Committee

Workshops and Seminars (Organized and Hosted by Faculty/Units)

Title	Location	Co-Organizers	Date
The Theory of Quantum Computation, Communication and Cryptography (TQC)	OIST Conference Center	Steering Committee : David Elkouss Coronas(OIST), Kae Nemoto (OIST) et. al, Organizing Committee :Kae Nemoto(OIST) et. al	2024-9
Okinawa School in Physics 2024: Coherent Quantum Dynamics	OIST Seaside House	Organizer: Síle Nic Chormaic (OIST), Thomas Busch(OIST), Kae Nemoto(OIST)	2024-9
Biological, Artificial, and Quantum Intelligence 2025 (BAQ2025)	OIST Main campus	Organizer: Kae Nemoto(OIST), Bill Munro(OIST), Gerald Pao(OIST), OIST Center for Quantum Technologies (OCQT, OIST)	2025-3