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Hiroki Sukeno

Research Profile My research studies quantum many-body physics through entanglement as an organizing principle. I explore how measurement can be used to steer entanglement and dynamics, enabling measurement-based and adaptive approaches to quantum simulation. My recent work focuses on new entanglement structures and their role in complex many-body dynamics.

POSITIONS

The University of New Mexico — Albuquerque, NM, USA
Postdoctoral Fellow — June 2025 — present
Funded by NSF FRHTP Program

EDUCATION

Stony Brook University — Stony Brook, NY, USA
C. N. Yang Institute for Theoretical Physics — Ph.D. degree
Ph.D. candidate (advisor: Tzu-Chieh Wei) — May 2025
M.A. degree in May 2020

The University of Tokyo — Meguro, Tokyo, Japan
Master of Arts (advisor: Yuji Okawa) — M.A. degree
- High Energy Theory — March 2017

The University of Tokyo — Bunkyo, Tokyo, Japan
Department of Physics — B.S. degree
- Focus on Astrophysics Experiment — March 2015

PUBLICATIONS

(I) Measurement-based frameworks for gauge symmetry and dynamics

1. **H. Sukeno**, K. Ikeda, and T.-C. Wei, "*Bulk and boundary entanglement transitions in the projective gauge-Higgs model*," Phys. Rev. B **110**, 245102 (2024). *[First author]*
2. T. Okuda, A. Parayil Mana, and **H. Sukeno**, "*Anomaly inflow for CSS and fractonic lattice models and dualities via cluster state measurement*," SciPost Physics **17**, 113 (2024). *[Co-first author (alphabetically ordered)]*
3. T. Okuda, A. Parayil Mana, and **H. Sukeno**, "*Anomaly inflow, dualities, and quantum simulation of abelian lattice gauge theories induced by measurements*," Phys. Rev. Research **6**, 043018 (2024). *[Co-first author (alphabetically ordered)]*
4. **H. Sukeno** and T.-C. Wei, "*Quantum simulation of lattice gauge theories via deterministic duality transformations assisted by measurements*," Phys. Rev. A **109**, 042611 (2024). *[First author]*
5. **H. Sukeno** and T. Okuda, "*Measurement-based quantum simulation of Abelian lattice gauge theories*," SciPost Phys. **14**, 129 (2023). *[First author]*

(II) Topological phases of matter and generalized symmetries via quantum circuits

6. A. Parayil Mana, Y. Li, **H. Sukeno**, and T.-C. Wei, *"Higher-order topological phases protected by non-invertible and subsystem symmetries"* cond-mat/2505.18119
7. A. Parayil Mana, Y. Li, **H. Sukeno**, and T.-C. Wei, "*Kennedy-Tasaki transformation and non-invertible symmetry in lattice models beyond one dimension*," Phys. Rev. B **109**, 245129 (2024).
8. Y. Li, **H. Sukeno**, A. Parayil Mana, H. P. Nautrup, T.-C. Wei, "*Symmetry-enriched topological order from partially gauging symmetry-protected topologically ordered states assisted by measurements*," Phys. Rev. B **108** (11) 115144 (2023).

(III) Quantum teleportation protocols & quantum algorithms

9. **H. Sukeno** and T.-C. Wei, "*Quantum gate broadcasting on graphs*" quant-ph/2503.10946 *[First author]*
10. N. A. Nghiem, **H. Sukeno**, S. Zhang, and T.-C. Wei, "*Improved Quantum Power Method and Numerical Integration Using a Quantum Singular-Value Transformation*," Phys. Rev. A **111**, 012434 (2025).
11. R. K. Malla, **H. Sukeno**, H. Yu, T.-C. Wei, A. Weichselbaum, and R.M. Konik, "*Feedback-based Quantum Algorithm Inspired by Counterdiabatic Driving*," Phys. Rev. Research 6, 043068 (2024).
12. **H. Sukeno**, T.-C. Wei, M. Hillery, J. Bergou, D. Fields, and V. S. Malinovski, "*Broadcasting single-qubit and multi-qubit-entangled states: authentication, cryptography, and distributed quantum computation*," Phys. Rev. A **107** (6) 062605 (2023). *[First author]*

(IV) Problems in broader high energy & condensed matter physics

13. S. Zhang, **H. Sukeno**, K. Ikeda, and T.-C. Wei, "*Local symmetries and extensive ground-state degeneracy of a one-dimensional supersymmetric fermionic chain*," Phys. Rev. B **111**, 235151 (2025).
14. H. Kunitomo, Y. Okawa, **H. Sukeno**, and T. Takezaki, "*Fermion scattering amplitudes from gauge-invariant actions for open superstring field theory*," arXiv preprint hep-th/1612.00777

[Alphabetically ordered]

TALK, SEMINAR, AND LECTURE

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1. [**conference**] "Progress on measurement-based quantum simulation of lattice gauge theories," APS Physics Global Summit, Denver, March 2026.
2. [**seminar** ***(invited)***] "Lattice gauge theory and adaptive quantum circuits," Seminar at the High Energy Theory group of the University of Tokyo, February 2026.
3. [**conference**] "Quantum gate broadcasting on graphs"APS Physics Global Summit, Anaheim, March 2025.
4. [**seminar** ***(postdoc interview)***] "Physics and quantum simulation of lattice gauge theory with mid-circuit measurement," Seminar at University of New Mexico, January 2025.
5. [**seminar** ***(postdoc interview)***] "Physics and quantum simulation of lattice gauge theory with mid-circuit measurement," Seminar at University of California Davis, January 2025.
6. [**poster**] "Bulk and boundary entanglement transitions in the projective gauge-Higgs model," Quantum information dynamics and non-equilibrium quantum matter, Simons Center for Geometry and Physics, Stony Brook University, December 2024.
7. [**seminar** ***(postdoc interview)***] "Lattice gauge theory from entanglement, measurement, and feedforward," Special Seminar at Pritzker School of Molecular Engineering in The University of Chicago, November 2024.
8. [**seminar** ***(postdoc interview)***] "Topological orders, quantum simulation, and quantum communication — physics in mid-circuit measurement paradigm ," Seminar at Virginia Tech (Blacksburgh), November 2024.
9. [**seminar** ***(postdoc interview)***] "Lattice gauge theory from entanglement, measurement, and feedforward," PCTS Special Seminar at Princeton University, October 2024.
10. [**seminar** ***(postdoc interview)***] "Lattice gauge theory from entanglement, measurement, and feedforward," GLAM Special Seminar at Stanford University, October 2024.
11. [**seminar**] "Lattice gauge theory from entanglement, measurement, and feedforward," YITP Stony Brook University, October 2024.
12. [**seminar**] "Lattice gauge theory from entanglement, measurement, and feedforward," High Energy Theory group at Osaka University, October 2024.
13. [**poster**] "Bulk and boundary entanglement transitions in the projective gauge-Higgs model," Physics of Quantum Information 2024, Perimeter Institute for Theoretical Physics, Waterloo, Canada

14. [**conference**] "Anomaly inflow, foliation, and measurement-based quantum simulation of abelian lattice gauge theories," APS March Meeting 2024, Minneapolis, USA
15. [**lecture** ***(invited)***] "Measurement-based quantum computation and lattice gauge theory," school held at Osaka University, Japan, October 2023
16. [**conference**] "Lattice gauge theories from measuring entangled states," Foundations and Developments of Quantum Information Theory, Yukawa Institute for Theoretical Physics, Kyoto University, Japan, September 2023
17. [**conference**] "Measurement-based quantum simulation of Abelian lattice gauge theories," It from Qubit 2023, Perimeter Institute, Canada, August 2023
18. [**seminar** ***(invited)***] "Measurement-based quantum simulation of Abelian lattice gauge theories," Hybrid RBRC seminar, Brookhaven National Laboratory, USA, May 2023
19. [**seminar** ***(invited)***] "Quantum Simulation of Gauge Theories from Entanglement, Measurement, and Feedforward," Extreme Universe Collaboration Circular Meeting, Japan, online, April 2023
20. [**seminar** ***(invited)***] "Quantum Simulation of Gauge Theories from Measuring Entangled States," Joint HEP-TH Seminar, China, online, March 2023
21. [**conference**] "Fermion scattering amplitudes from gauge-invariant actions of open superstring field theory," String Field Theory and String Phenomenology 2018, Harish-Chandra Research Institute, India, February 2018
22. [**seminar** ***(invited)***] "Fermion scattering amplitudes from gauge-invariant actions for open superstring field theory," seminar at Tokyo Institute of Technology, Japan, 2017
23. [**poster**] "Fermion scattering amplitudes from gauge-invariant actions for open superstring field theory," YITP international workshop Strings and Fields 2016, Yukawa Institute for Theoretical Physics, Japan, 2016
24. [**conference**] "Fermion scattering amplitudes from gauge-invariant actions of open superstring field theory," Japan Physics Society 2016, Tohoku Gakuin University, Japan, 2016

FELLOWSHIP

- Focused Research Hubs in Theoretical Physics Prize Fellow, 2025 – present
- Ito Foundation U.S.A.-FUTI scholarship, 2018-2020: a scholarship for international graduate studies

AWARD

- Rosaline and Milton Sterman Travel Award, YITP Stony Brook University, August 2024
- Peter B. Kahn Prize, outstanding research and travel award, Stony Brook University, May 2023
- Outstanding Student Award, School of Arts and Sciences, University of Tokyo, March 2017
- Full repayment exemption from JASSO student loan for academic excellence, March 2017

REFEREE SERVICE

- Conference: Quantum Information Processing 2025, 2026
- Journal
  APS: Physical Review A, Physical Review X, PRX Quantum, Physical Review Letters
  Nature Publishing group: Communications Physics
  Springer Nature: International Journal of Theoretical Physics
  SciPost: SciPost Physics

ACADEMIC SERVICE

- Co-organizer of SQuInT 2025
- Volunteer program facilitator for QIS 303, Quantum Error Mitigation Program, C2QA, August 2024
- Member of Extreme Universe Collaboration, Grant-in-Aid for Transformative Research Areas (A)

MENTORING SERVICE

- Mentored a Master student of Prof. Wei at Stony Brook (see preprint 2206.14028).
- Volunteer TA for Quantum EduQation Professional Development Workshop, Stony Brook University, 2023-2024.
- Summer school advisor for General Incorporated Association Glocal Academy, August 2018.

TEACHING POSITIONS

- The University of Tokyo. Teaching Assistant: Waves and Oscillations, First-Year Seminar for Natural Sciences Students.
- Stony Brook University. Teaching Assistant: Physics Lab (undergraduate), Graduate Lab, Physics Lab for Life Sciences.
- Waseda Academy Co. Part-time lecturer: high school math & physics (2013-2018)

LINK

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