updated 1/18/2025

Hiroki Sukeno

Ph.D. candidate at C. N. Yang Institute for Theoretical Physics,
Stony Brook University

Research interest

Quantum technology and theoretical physics.

- **Quantum information science**: Quantum computation, quantum simulation, quantum communication, quantum error correction.
- **Condensed matter physics**: topological order, phase transition, numerical simulation.
- **High energy physics**: new types of symmetries, gauge theory, string theory.

Skills

- Theoretical physics research (10+ research papers).
- Oral and written presentation (10+ oral presentations at seminars, conferences, and an invited lecture).
- Numerical simulation in Python, Julia, and Mathematica.

Languages

English and Japanese

PAPER

＊(Co-)first authors and authors listed alphabetically are indicated by underlines. The author ordering convention depends on the field of the work, e.g. high energy physics or condensed matter physics.

Published papers

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). https://doi.org/10.1103/PhysRevB.110.245102
2. 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). https://doi.org/10.1103/PhysRevResearch.6.043068
3. 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). doi:10.21468/SciPostPhys.17.4.113
4. 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). https://doi.org/10.1103/PhysRevResearch.6.043018
5. 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). https://doi.org/10.1103/PhysRevB.109.245129
6. 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). https://doi.org/10.1103/PhysRevA.109.042611
7. 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). https://doi.org/10.1103/PhysRevB.108.115144
8. 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), https://doi.org/10.1103/PhysRevA.107.062605
9. H. Sukeno and T. Okuda, "*Measurement-based quantum simulation of Abelian lattice gauge theories*," SciPost Phys. **14**, 129 (2023). 10.21468/SciPostPhys.14.5.129

Preprints accepted by journals

1. N. A. Nghiem, H. Sukeno, S. Zhang, and T.-C. Wei, "*Improved Quantum Power Method and Numerical Integration Using Quantum Singular Value Transformation*," arXiv:2407.11744 , accepted by Phys. Rev. A.

Other preprints

1. S. Zhang, H. Sukeno, K. Ikeda, and T.-C. Wei, "Local symmetries and extensive ground-state degeneracy of a 1D supersymmetric fermionic chain" cond-mat/2412.17208
2. 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

TALK AND SEMINAR

1. [**seminar**] "Physics and quantum simulation of lattice gauge theory with mid-circuit measurement," Seminar at University of California Davis, January 2025.
2. [**conference: 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.
3. [**seminar**] "Lattice gauge theory from entanglement, measurement, and feedforward," Special Seminar at Pritzker School of Molecular Engineering in The University of Chicago, November 2024.
4. [**seminar**] "Topological orders, quantum simulation, and quantum communication — physics in mid-circuit measurement paradigm ," Seminar at Virginia Tech (Blacksburgh), November 2024.
5. [**seminar**] "Lattice gauge theory from entanglement, measurement, and feedforward," PCTS Special Seminar at Princeton University, October 2024.
6. [**seminar**] "Lattice gauge theory from entanglement, measurement, and feedforward," GLAM Special Seminar at Stanford University, October 2024.
7. [**seminar**] "Lattice gauge theory from entanglement, measurement, and feedforward," YITP Stony Brook University, October 2024.
8. [**seminar (informal)**] "Lattice gauge theory from entanglement, measurement, and feedforward," High Energy Theory group at Osaka University, October 2024.
9. [**conference: poster**] "Bulk and boundary entanglement transitions in the projective gauge-Higgs model," Physics of Quantum Information 2024, Perimeter Institute for Theoretical Physics, Waterloo, Canada

10. [**conference: oral**] "Anomaly inflow, foliation, and measurement-based quantum simulation of abelian lattice gauge theories," APS March Meeting 2024, Minneapolis, USA
11. [**conference: oral**] "Lattice gauge theories from measuring entangled states," Foundations and Developments of Quantum Information Theory, Yukawa Institute for Theoretical Physics, Kyoto University, Japan, September 2023
12. [**conference: oral**] "Measurement-based quantum simulation of Abelian lattice gauge theories," It from Qubit 2023, Perimeter Institute, Canada, August 2023
13. [**seminar**] "Measurement-based quantum simulation of Abelian lattice gauge theories," Hybrid RBRC seminar, Brookhaven National Laboratory, USA, May 2023
14. [**seminar**] "Quantum Simulation of Gauge Theories from Entanglement, Measurement, and Feedforward," Extreme Universe Collaboration Circular Meeting, Japan, online, April 2023
15. [**seminar**] "Quantum Simulation of Gauge Theories from Measuring Entangled States," Joint HEP-TH Seminar, China, online, March 2023
16. [**conference: oral**] "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
17. [**seminar**] "Fermion scattering amplitudes from gauge-invariant actions for open superstring field theory," seminar at Tokyo Institute of Technology, Japan, 2017
18. [**conference: 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
19. [**conference: oral**] "Fermion scattering amplitudes from gauge-invariant actions of open superstring field theory," Japan Physics Society 2016, Tohoku Gakuin University, Japan, 2016

LECTURE

1. [**invited lecture**] "Measurement-based quantum computation and lattice gauge theory," school held at Osaka University, Japan, October 2023

AWARD AND SCHOLARSHIP

- 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
- Ito Foundation U.S.A.-FUTI scholarship, 2018-2020: a scholarship for international graduate studies.
- Outstanding Student Award, School of Arts and Sciences, University of Tokyo, March 2017

EDUCATION

Stony Brook University — Stony Brook, NY, USA
C. N. Yang Institute for Theoretical Physics — Ph.D. degree expected in August 2025
Ph.D. candidate (advisor: Tzu-Chieh Wei)
- Quantum Information Science
- Condensed Matter Theory

M.A. degree in May 2020

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

The University of Tokyo — Bunkyo, Tokyo, Japan
Department of Physics — B.S. degree in March 2015
Bachelor of Science
- Physics
- Astrophysics Experiment

TEACHING & WORK EXPERIENCE

The University of Tokyo

Teaching Assistant:

- Waves and Oscillations
- First-Year Seminar for Natural Sciences Students

Stony Brook University

Teaching Assistant:

- Physics Lab
- Graduate Lab
- Physics Lab for Life Sciences

Research Assistant at Tzu-Chieh Wei's group

Waseda Academy Co.

Part-time lecturer: high school math & physics (2013-2018)

SERVICE AND VOLUNTEER

- Volunteer program facilitator for QIS 303, Quantum Error Mitigation Program, C2QA, August 2024.
- Volunteer TA for Quantum EduQation Professional Development Workshop, Stony Brook University, 2023-2024.
- Mentor for general Incorporated Association Glocal Academy, advisor in summer school, August 2018.
- Member of Extreme Universe Collaboration, Grant-in-Aid for Transformative Research Areas (A).
- Mentored a Master student at Prof. Wei's group.
- Subreviewer for QIP 2025.

LINK

Email: hiroki.sukeno[at]gmail.com

Website: https://sites.google.com/view/hirokisukeno/home

Google Scholar: https://scholar.google.com/citations?user=JXno38AAAAAJ&hl=en