HYUNWOO OH

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RESEARCH INTERESTS

Numerical problems in Monte Carlo calculations; Machine learning applications in physics; Quantum simulation of field theories

EDUCATION

University of Maryland   College Park, MD
Ph.D. Candidate in Physics (Advisors: Paulo Bedaque, Thomas Cohen)   Sep. 2020 – Present

Yonsei University   Seoul, Korea
B.S. in Physics, B.S. in Mathematics   2013 – 2019
Graduated with Highest Honors, Valedictorian

RESEARCH EXPERIENCE

Nuclear Theory Group   College Park, MD
Research Assistant   Sep. 2020 – Present

- Working on numerical issues of Monte Carlo calculations using various methods, including machine learning
  - Solved infinite variance problem by adding extra variables in Monte Carlo sampling and reweighting
  - Studying physical systems that is limited to signal-to-noise problem using control variates method combined with machine learning
- Finding efficient ways to prepare eigenstates on quantum computers
  - Removed exponential fluctuations of Rodeo projection algorithm and found more than twice faster projection
  - Made a state preparation method with quadratic speedup over adiabatic preparation and the quantum Zeno effect
  - Studying various aspects of errors in adiabatic state preparation for applying it to simulation of field theories

PAPERS

[10] Hyunwoo Oh, *Training neural control variates using correlated configurations*, arXiv:2505.07719 [hep-lat]

[9] Thomas D. Cohen, Andrew Li, Hyunwoo Oh, and Maneesha Sushama Pradeep, *On the utility of the switching theorem for adiabatic state preparation*, arXiv:2502.06534 [quant-ph]

[8] Thomas D. Cohen and Hyunwoo Oh, *Asymptotic errors in adiabatic evolution*, Phys. Rev. A **111**, 042612 (2025), arXiv:2501.10641 [quant-ph]

[7] Thomas D. Cohen, Hyunwoo Oh, and Veronica Wang, *Numerical study of computational cost of maintaining adiabaticity for long paths*, arXiv:2412.08626 [quant-ph]

[6] Thomas D. Cohen and Hyunwoo Oh, *Corrections to adiabatic behavior for long paths*, Phys. Rev. A **110**, 062601 (2024), arXiv:2405.10294 [quant-ph]

[5] Paulo F. Bedaque and Hyunwoo Oh, *Leveraging neural control variates for enhanced precision in lattice field theory*, Phys. Rev. D **109**, 094519 (2024), arXiv:2312.08228 [hep-lat]

[4] Thomas D. Cohen and Hyunwoo Oh, *Efficient vacuum-state preparation for quantum simulation of strongly interacting local quantum field theories*, Phys. Rev. A **109**, L020402 (2024), arXiv:2310.19229 [hep-lat]

[3] Thomas D. Cohen and Hyunwoo Oh, *Optimizing the rodeo projection algorithm*, Phys. Rev. A **108**, 032422 (2023), arXiv:2305.19952 [quant-ph]

[2] Andrei Alexandru, Paulo F. Bedaque, Andrea Carosso, and Hyunwoo Oh, *Infinite variance problem in fermion models*, Phys. Rev. D **107**, 094502 (2023), arXiv:2211.06419 [hep-lat]

[1] Scott Lawrence, Hyunwoo Oh, and Yukari Yamauchi, *Lattice scalar field thoery at complex coupling*, Phys. Rev. D **106**, 114503 (2022), arXiv:2205.12303 [hep-lat]

PROCEEDINGS

[2] Hyunwoo Oh, *Control variates with neural networks*, PoS LATTICE2024 051, arXiv:2501.14614 [hep-lat]

[1] Hyunwoo Oh, Andrei Alexandru, Paulo F. Bedaque, and Andrea Carosso, *A solution for infinite variance problem of fermionic observables*, PoS LATTICE2023 021, arXiv:2311.16074 [hep-lat]

TALKS

[7] *Neural control variates for variance reduction* (Poster), USQCD All-Hands Meeting 2025 , College Park, MD, March 2025

[6] *Control variates with neural networks*, Lattice 2024 at Liverpool, UK, July 2024

[5] *State preparation of local quantum field theories using projection*, HEP-QIS Forum at Fermilab, Batavia, IL, October 2023

[4] *State preparation of local quantum field theories using quantum Zeno effect*, Nuclear Theory Seminar at UMD, College Park, MD, October 2023

[3] *A solution for infinite variance problem of fermionic observables*, Lattice 2023 at Fermilab, Batavia, IL, August 2023

[2] *Infinite variance problem in lattice fermions*, Nuclear Theory Seminar at UMD, College Park, MD, November 2022

[1] *Lattice scalar field theory at complex coupling*, Fall 2022 Meeting of the APS Division of Nuclear Physics, New Orleans, LA, October 2022

HONORS AND FELLOWSHIPS

Dean's Fellowship, University of Maryland	2020 – 2022
Kwanjeong Domestic Scholarship, Kwanjeong Educational Foundation	2015 – 2019
National Science & Technology Scholarship, Korea Student Aid Foundation	Fall 2014
Truth Scholarship (Merit based), Yonsei University	Spring 2014, Fall 2013
Dean's List, Yonsei University	2013 – 2016, 2018

WORK EXPERIENCE

Samsung Electronics — Hwaseong, Korea
Process Integration Engineer — Mar. 2019 – Mar. 2020

- Responsible for designing DRAM process integration
- Participated in a project on developing a next-generation DRAM product

Military Service in Republic of Korea Air Force — Seongnam, Korea
Staff Sergeant — Sep. 2016 – Sep. 2018

- Responsible for driving military vehicles
- Worked as a counselor and a representative of mandatory military service soldiers

MENTEES

- Veronica Wang, Summer 2024
- Andrew Li, Summer 2024

SKILLS

Programming   Python, Mathematica, C++
Software & Tools   JAX, Numpy, Scipy, Pandas, scikit-learn, Git, Linux

Last updated: September 19, 2025