

CONTACT

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RESEARCH INTERESTS

Nuclear and particle physics; Nonperturbative aspects of quantum field theory; Sign problem in Monte Carlo studies of field theories (finite fermion density, real-time observables); Applications of quantum computers to lattice field theories

HISTORY

Feynman fellow, Theoretical Division T-2, Los Alamos National Laboratory, 2023-.

Postdoctoral research, University of Colorado, Boulder, 2020-2023. Advisor: Paul Romatschke.

Ph.D., Physics, University of Maryland, College Park, 2017-2020. Thesis advisor: Paulo F. Bedaque.

Graduate research, Astronomy, University of Maryland, College Park, 2015-2017.

B.S., Physics and Computer Science, University of Maryland, College Park, 2011-2015.

MENTEES

Siddhartha Harmalkar, 2018-2020.

Hersh Kumar, Summers 2019 and 2020.

Arlee Shelby, Fall 2022.

Anurag Ranjan, Fall 2022.

PAPERS

- [30] Scott Lawrence, Yukari Yamauchi. *Convex optimization of contour deformations*. [arXiv:2311.13002](#) (2023).
- [29] Tanmoy Bhattacharya, Scott Lawrence, Jun-Sik Yoo. *Control variates for lattice field theory*. [arXiv:2307.14950](#) (2023).
- [28] Scott Lawrence, Christian Peterson, Paul Romatschke, Ryan Weller. *Instantons, analytic continuation, and \mathcal{PT} -symmetric field theory*. [arXiv:2303.01470](#) (2023).
- [27] Scott Lawrence, Yukari Yamauchi. *Deep Learning of Fermion Sign Fluctuations*. [arXiv:2212.14606](#) (2022).
- [26] Scott Lawrence. *Semidefinite Programs at Finite Fermion Density*. [arXiv:2211.08874](#) (2022).

- [25] Scott Lawrence, Paul Romatschke. *On the Gravitational Wave to Matter Coupling of Superfluid Fermi Gases Near Unitarity*. [arXiv:2206.04765](#) (2022).
- [24] Scott Lawrence, Hyunwoo Oh, Yukari Yamauchi. *Lattice Scalar Field Theory At Complex Coupling*. *Phys.Rev.D* 106 (2022) 11, 114503.
- [23] Scott Lawrence. *Bootstrapping Lattice Vacua*. [arXiv:2111.13007](#) (2021).
- [22] Scott Lawrence. *Resurrecting the Strong KSS Conjecture*. [arXiv:2111.08158](#) (2021).
- [21] Thomas Cohen, Henry Lamm, Scott Lawrence, Yukari Yamauchi. *Quantum algorithms for transport coefficients in gauge theories*. *Phys.Rev.D* 104 (2021) 9, 094514.
- [20] Scott Lawrence, Yukari Yamauchi. *Normalizing Flows and the Real-Time Sign Problem*. *Phys.Rev.D* 103 (2021) 11, 114509.
- [19] Scott Lawrence. *Perturbative Removal of a Sign Problem*. *Phys.Rev.D* 102 (2020) 9, 094504.
- [18] Thomas D. Cohen, Scott Lawrence, Yukari Yamauchi *The thermodynamics of large- N QCD and the nature of metastable phases*. *Phys.Rev.C* 102 (2020) 6, 065206.
- [17] NuQS Collaboration (Henry Lamm, Scott Lawrence, Yukari Yamauchi). *Suppressing Coherent Gauge Drift in Quantum Simulations*. [arXiv:2005.12688](#) (2020).
- [16] Scott Lawrence, Zeeve Rogoszinski. *The Brute-Force Search for Planet Nine*. [arXiv:2004.14980](#) (2020).
- [15] Scott Lawrence. *Sign Problems in Quantum Field Theory: Classical and Quantum Approaches*. Doctoral thesis (2020).
- [14] NuQS Collaboration (Siddhartha Harmalkar, Henry Lamm, Scott Lawrence). *Quantum Simulation of Field Theories Without State Preparation*. [arXiv:2001.11490](#) (2020).
- [13] Andrei Alexandru, Paulo F. Bedaque, Scott Lawrence. *Quantum algorithms for disordered physics*. *Phys.Rev A*101 (2020) no.3, 032325.
- [12] NuQS Collaboration (Henry Lamm, Scott Lawrence, Yukari Yamauchi). *Parton physics on a quantum computer*. *Phys.Rev.Res.* 2 (2020) no.1, 013272.
- [11] NuQS Collaboration (Andrei Alexandru, Paulo F. Bedaque, Siddhartha Harmalkar, Henry Lamm, Scott Lawrence, Neill C. Warrington). *Gluon Field Digitization for Quantum Computers*. *Phys.Rev. D*100 (2019) no.11, 114501.
- [10] NuQS Collaboration (Henry Lamm, Scott Lawrence, Yukari Yamauchi). *General Methods for Digital Quantum Simulation of Gauge Theories*. *Phys.Rev. D*100 (2019) no.3, 034518.
- [9] NuQS Collaboration (Andrei Alexandru, Paulo F. Bedaque, Henry Lamm, Scott Lawrence). *Sigma models on quantum computers*. *Phys.Rev.Lett.* 123 (2019) no.9, 090501.

- [8] Andrei Alexandru, Paulo F. Bedaque, Henry Lamm, Scott Lawrence, Neill C. Warrington. *Fermions at Finite Density in 2+1 Dimensions with Sign-Optimized Manifolds*. Phys.Rev.Lett. 121 (2018) no.19, 191602.
- [7] Andrei Alexandru, Gökce Basar, Paulo F. Bedaque, Henry Lamm, Scott Lawrence. *Finite Density QED₁₊₁ Near Lefschetz Thimbles*. Phys.Rev. D98 (2018) no.3, 034506.
- [6] Henry Lamm, Scott Lawrence. *Simulation of Nonequilibrium Dynamics on a Quantum Computer*. Phys.Rev.Lett. 121 (2018) no.17, 170501.
- [5] Andrei Alexandru, Paulo F. Bedaque, Henry Lamm, Scott Lawrence. *Finite-Density Monte Carlo Calculations on Sign-Optimized Manifolds*. Phys.Rev. D97 (2018) no.9, 094510.
- [4] Andrei Alexandru, Paulo F. Bedaque, Henry Lamm, Scott Lawrence. *Deep Learning Beyond Lefschetz Thimbles*. Phys.Rev. D96 (2017) no.9, 094505.
- [3] Scott Lawrence, Justin G. Tervalá, Paulo F. Bedaque, M. Coleman Miller. *An Upper Bound on Neutron Star Masses from Models of Short Gamma-ray Bursts*. Astrophys.J. 808 (2015) 186.
- [2] Scott Lawrence, Qin Liu, Victor Yakovenko. *Global Inequality in Energy Consumption from 1980 to 2010*. Entropy 15, no. 12: 55655579 (2013).
- [1] Christopher Brust, Andrey Katz, Scott Lawrence, Raman Sundrum. *SUSY, the Third Generation and the LHC*. Journal of High Energy Physics 2012:103 (2011).

PROCEEDINGS

- Yukari Yamauchi, Scott Lawrence. *Normalizing flows for the real-time sign problem*. arXiv:2112.15035 (2021).
- Scott Lawrence. *Real-Time Dynamics at Large N*. arXiv:2112.15016 (2021).
- Scott Lawrence. *Beyond Thimbles: Sign-Optimized Manifolds for Finite Density*. PoS LATTICE2018 (2018) 149.

SELECTED TALKS

- Machines Learning to Solve Sign Problems*. SIGN'22 (2022) at Tel Aviv University.
- Sign Problems, Contour Deformations, and Computational Complexity*. CU Boulder (2021).
- Real-Time Dynamics at Large N*. LATTICE (2021).
- The Quantum Computer in the S-Matrix*. YITP (2021).
- Classical Algorithms for Quantum Dynamics: Progress and Prospects*. University of Washington (2021).
- From Qubits to Quarks: Parton Physics on a Quantum Computer*. DNP Meeting (2019).
- Analytic Continuation and the Real-Time Sign Problem*. SIGN'19 (2019).

Quantum Simulation of Gauge Theory. Seminar, The George Washington University (2019).

Manifolds of Glory: Complex Contours for Ameliorating the Sign Problem. SIGN'18 in Universität Bielefeld (2018).

Beyond thimbles: Sign-optimized manifolds for finite density. LATTICE (2018).

Beyond thimbles: Integration contours to solve a sign problem. Nuclear theory seminar, University of Maryland (2018).

Approximating waveforms of rapidly rotating neutron stars. 21st International Conference On General Relativity and Gravitation (2016).