Benjamin Cohen-Stead

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Personal Website
Google Scholar
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GitHub

Education

University of California, Davis — Davis, Ca
Ph.D. in Physics — 2016–2022

- Advisor: Prof. Richard Scalettar
- Thesis: A Hybrid Quantum Monte Carlo Method for Electron-Phonon Models

Whitman College — Walla Walla, Wa
B.A. in Physics — 2010–2014

Professional Experience

University of Tennessee, Knoxville — Knoxville, Tn
Research Assistant Professor — 2024–present

University of Tennessee, Knoxville — Knoxville, Tn
Postdoctoral Research Associate — 2022–2024

- Principal Investigator: Prof. Steven Johnston

Los Alamos National Laboratory — Los Alamos, NM
Graduate Student Researcher — 2020–2022

- Mentor: Dr. Kipton Barros
- Project: Langevin Methods for Quantum Electron-Phonon Simulations

Picarro, Inc. — Santa Clara, Ca
Associate Data Scientist — 2014–2016

- Responsibilities: software development, algorithm design, data analysis

Picarro, Inc. — Santa Clara, Ca
Data Science Intern — Summer 2014

University of Rochester, Department of Physics — Rochester, NY
Physics REU Student, Mentor: Professor Stephen Teitel — Summer 2013

- Research: numerical investigation of two-dimensional granular systems

Grants & Awards

Scientific Software Research Faculty (SSRF) Award — 2024–2029
Organization: Simons Foundation

- Principle Investigator: Dr. Benjamin Cohen-Stead
- Project: User-friendly and Extensible Quantum Monte Carlo Related Tools

UC-National Lab In-Residence Graduate Fellowship — 2020–2022
Organization: Los Alamos National Laboratory (LANL)

- Mentor: Dr. Kipton Barros
- Project: Langevin Methods for Quantum Electron-Phonon Simulations

Open Source Codes

SmoQyDQMC.jl: https://github.com/SmoQySuite/SmoQyDQMC.jl.git
Flexible implementation of the determinant quantum Monte Carlo method for simulating Hubbard and electron-phonon interactions.

SmoQySynthAC.jl: https://github.com/SmoQySuite/SmoQySynthAC.jl.git
A package for generating synthetic noisy correlation function data intended to mimic that generated by a quantum Monte Carlo simulation. This package is useful for testing efficacy of various analytic continuation methods.

SmoQyHankelCorrCleaner.jl: https://github.com/SmoQySuite/SmoQyHankelCorrCleaner.jl.git
Julia package exporting methods for denoising imaginary time correlation correlation data using the Hankel projection method introduced in arXiv:2403.12349

JDQMCFramework.jl: https://github.com/SmoQySuite/JDQMCFramework.jl.git
Julia package exporting a suite of types and routines useful for writing a determinant quantum Monte Carlo code.

JDQMCMeasurements.jl: https://github.com/SmoQySuite/JDQMCMeasurements.jl.git
Julia package implementing various correlation measurements that are frequently made in determinant quantum Monte Carlo simulations.

StableLinearAlgebra.jl: https://github.com/SmoQySuite/StableLinearAlgebra.jl.git
Exports numerically stable linear algebra routines used in determinant quantum Monte Carlo codes.

Checkerboard.jl: https://github.com/SmoQySuite/Checkerboard.jl.git
Implements the checkerboard approximation for representing exponentiated kinetic for tight-binding models.

LatticeUtilities.jl: https://github.com/SmoQySuite/LatticeUtilities.jl.git
Julia package for representing arbitrary periodic lattice geometries.

MuTuner.jl: https://github.com/cohensbw/MuTuner.jl.git
Implements a method for tuning the chemical potential in grand canonical Monte Carlo simulations to achieve a target particle density.

Patents

Aggregate leak indicator display systems and methods US Patent Number: 10962437
Assignee: Picarro, Inc. Date of Patent: March 30, 2021

- Inventors: A. Nottrott, S. MacMullin, S.M. Tan, B. Cohen-Stead, C. Rella

Publications

[1] B. Cohen-Stead, S. M. Costa, J. Neuhaus, A. T. Ly, Y. Zhang, R. Scalettar, K. Barros, and S. Johnston, "SmoQyDQMC.jl: A flexible implementation of determinant quantum Monte Carlo for Hubbard and electron-phonon interactions", *SciPost Phys. Codebases*, p. 29, 2024. DOI: 10.21468/SciPostPhysCodeb.29.

[2] B. Cohen-Stead, K. Barros, R. Scalettar, and S. Johnston, "A hybrid Monte Carlo study of bond-stretching electron–phonon interactions and charge order in $BaBiO_3$", *npj Computational Materials*, vol. 9, no. 1, p. 40, 2023. DOI: 10.1038/s41524-023-00998-6.

[3] B. Cohen-Stead, O. Bradley, C. Miles, G. Batrouni, R. Scalettar, and K. Barros, "Fast and scalable quantum Monte Carlo simulations of electron-phonon models", *Phys. Rev. E*, vol. 105, p. 065 302, 6 Jun. 2022. DOI: 10.1103/PhysRevE.105.065302.

[4] B. Cohen-Stead, K. Barros, Z. Meng, C. Chen, R. T. Scalettar, and G. G. Batrouni, "Langevin simulations of the half-filled cubic holstein model", *Phys. Rev. B*, vol. 102, p. 161 108, 16 Oct. 2020. DOI: 10.1103/PhysRevB.102.161108.

[5] B. Cohen-Stead, N. C. Costa, E. Khatami, and R. T. Scalettar, "Effect of strain on charge density wave order in the holstein model", *Phys. Rev. B*, vol. 100, p. 045 125, 4 Jul. 2019. DOI: 10.1103/PhysRevB.100.045125.

[6] M. Naamneh, E. Paris, D. McNally, Y. Tseng, W. R. Pudelko, D. J. Gawryluk, J. Shamblin, E. OQuinn, B. Cohen-Stead, M. Shi, *et al.*, "Persistence of small polarons into the superconducting phase of $Ba_{1-x}K_xBiO_3$", *arXiv preprint arXiv:2408.00401*, 2024. DOI: 10.48550/arXiv.2408.00401.

[7] S. Malkaruge Costa, B. Cohen-Stead, and S. Johnston, "Kekulé valence bond order in the honeycomb lattice optical su-schrieffer-heeger model and its relevance to graphene", *Phys. Rev. B*, vol. 110, p. 115 130, 11 Sep. 2024. DOI: 10.1103/PhysRevB.110.115130.

[8] J. Neuhaus, N. S. Nichols, D. Banerjee, B. Cohen-Stead, T. A. Maier, A. Del Maestro, and S. Johnston, "Smoqydeac. jl: A differential evolution package for the analytic continuation of imaginary time correlation functions", *arXiv preprint arXiv:2407.04568*, 2024. DOI: 10.48550/arXiv.2407.04568.

[9] P. Mai, B. Cohen-Stead, T. A. Maier, and S. Johnston, "Fluctuating charge-density-wave correlations in the three-band hubbard model", *arXiv:2405.13164*, 2024. DOI: 10.48550/arXiv.2405.13164.

[10] A. Tanjaroon Ly, B. Cohen-Stead, S. Malkaruge Costa, and S. Johnston, "Comparative study of the superconductivity in the holstein and optical su-schrieffer-heeger models", *Phys. Rev. B*, vol. 108, p. 184 501, 18 Nov. 2023. DOI: 10.1103/PhysRevB.108.184501.

[11] S. Malkaruge Costa, B. Cohen-Stead, A. T. Ly, J. Neuhaus, and S. Johnston, "Comparative determinant quantum monte carlo study of the acoustic and optical variants of the su-schrieffer-heeger model", *Phys. Rev. B*, vol. 108, p. 165 138, 16 Oct. 2023. DOI: 10.1103/PhysRevB.108.165138.

[12] S. Karakuzu, B. Cohen-Stead, C. D. Batista, S. Johnston, and K. Barros, "Flexible class of exact hubbard-stratonovich transformations", *Phys. Rev. E*, vol. 107, p. 055 301, 5 May 2023. DOI: 10.1103/PhysRevE.107.055301.

[13] O. Bradley, B. Cohen-Stead, S. Johnston, K. Barros, and R. T. Scalettar, "Charge order in the kagome lattice Holstein model: A hybrid Monte Carlo study", *npj Quantum Materials*, vol. 8, no. 1, p. 21, 2023. DOI: 10.1038/s41535-023-00553-y.

[14] P. M. Dee, B. Cohen-Stead, S. Johnston, and P. J. Hirschfeld, "Charge correlations suppress unconventional pairing in the holstein model", *Phys. Rev. B*, vol. 107, p. 104 503, 10 Mar. 2023. DOI: 10.1103/PhysRevB.107.104503.

[15] C. Miles, B. Cohen-Stead, O. Bradley, S. Johnston, R. Scalettar, and K. Barros, "Dynamical tuning of the chemical potential to achieve a target particle number in grand canonical Monte Carlo simulations", *Phys. Rev. E*, vol. 105, p. 045 311, 4 Apr. 2022. DOI: 10.1103/PhysRevE.105.045311.

[16] G. Paleari, F. Hébert, B. Cohen-Stead, K. Barros, R. Scalettar, and G. G. Batrouni, "Quantum monte carlo study of an anharmonic holstein model", *Phys. Rev. B*, vol. 103, p. 195 117, 19 May 2021. DOI: 10.1103/PhysRevB.103.195117.