Benjamin Cohen-Stead

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Personal Website
Google Scholar
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GitHub

Professional Experience

2024–present — University of Tennessee, Knoxville
Research Assistant Professor — Department of Physics & Astronomy

2022–2024 — University of Tennessee, Knoxville
Postdoctoral Research Associate — Department of Physics & Astronomy
- Supervisor: Professor Steven Johnston

2020–2022 — Los Alamos National Laboratory
Graduate Student Researcher
- Supervisor: Dr. Kipton Barros

2014–2016 — Picarro, Inc.
Associate Data Scientist

Summer, 2014 — Picarro, Inc.
Data Science Intern

Education

University of California, Davis — Davis, Ca
Ph.D. in Physics — 2016–2022
- Advisor: Professor Richard Scalettar

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

Grants & Awards

Scientific Software Research Faculty 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)
- Supervisor: Dr. Kipton Barros
- Project: Langevin Methods for Quantum Electron-Phonon Simulations

Talks

JuliaCon July 25, 2025
Computational Chemisty and Materials Science Minisymposium Pittsburgh, Pa

- Title: Simulating Strongly-Correlated Material Models

Physics Seminar November 8, 2023
San Jose State University Department of Physics & Astronomy

- Title: Revisiting the bismuthate family of high-T_c superconductors with a modern tool kit
- Host: Professor Ehsan Khatami

Condensed Matter Physics Seminar October 18, 2023
University of Tennessee, Knoxville Department of Physics & Astronomy

- Title: Bond-Stretching Electron-Phonon Interactions in $BaBiO_3$
- Host: Professor Steven Johnston

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.

SmoQyKPMCore.jl: https://github.com/SmoQySuite/SmoQyKPMCore.jl.git
A lightweight and flexible implementation of the Kernel Polynomial Method (KPM) for approximating function of Hermitian m

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

[1] A. Nottrott, S. MacMullin, B. Cohen-Stead, C. W. Rella, and S. M. Tan, "Aggregate leak indicator display systems and methods", Utility patent US10962437B1, 2021.

Preprints

[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 (version 2.0 release)", *arXiv preprint arXiv:2311.09395*, 2026. DOI: 10.48550/arXiv.2311.09395.

[2] C. Jordan, G. Issa, E. Khatami, R. Scalettar, B. Cohen-Stead, and S. Johnston, "Charge order in the half-filled bond-Holstein model", *arXiv preprint arXiv:2601.13121*, 2026. DOI: 10.48550/arXiv.2601.13121.

[3] S. M. Costa, B. Cohen-Stead, and S. Johnston, "Antiferromagnetism and Kekulé valence bond order in the honeycomb optical Su-Schrieffer-Heeger-Hubbard model", *arXiv preprint arXiv:2511.21440*, 2025. DOI: 10.48550/arXiv.2511.21440.

Publications

[1] M. Naamneh, E. C. O'Quinn, E. Paris, D. McNally, Y. Tseng, W. R. Pudełko, D. J. Gawryluk, J. Shamblin, B. Cohen-Stead, M. Shi, M. Radovic, M. K. Lang, T. Schmitt, S. Johnston, and N. C. Plumb, "Persistence of small polarons into the superconducting doping range of $Ba_{1-x}K_xBiO_3$", *Phys. Rev. Res.*, vol. 7, p. 043 082, 4 Oct. 2025. DOI: 10.1103/s3p1-cy1s.

[2] Y. Zhang, P. M. Dee, B. Cohen-Stead, T. A. Maier, S. Johnston, and R. Scalettar, "Optimizing the critical temperature and superfluid density of a metal-superconductor bilayer", *Phys. Rev. B*, vol. 112, p. 064 510, 6 Aug. 2025. DOI: 10.1103/lcgr-bqcv.

[3] A. Tanjaroon Ly, B. Cohen-Stead, and S. Johnston, "Antiferromagnetic and bond-order-wave phases in the half-filled two-dimensional optical Su-Schrieffer-Heeger-Hubbard model", *Phys. Rev. B*, vol. 111, p. 245 138, 24 Jun. 2025. DOI: 10.1103/2bnf-tmtc.

[4] P. Mai, B. Cohen-Stead, T. A. Maier, and S. Johnston, "Fluctuating charge-density-wave correlations in the three-band Hubbard model", *Proceedings of the National Academy of Sciences*, vol. 121, no. 50, e2408717121, 2024. DOI: 10.1073/pnas.2408717121. eprint: https://www.pnas.org/doi/pdf/10.1073/pnas.2408717121.

[5] J. Neuhaus, N. S. Nichols, D. Banerjee, B. Cohen-Stead, T. A. Maier, A. D. Maestro, and S. Johnston, "SmoQyDEAC.jl: A differential evolution package for the analytic continuation of imaginary time correlation functions", *SciPost Phys. Codebases*, p. 39, 2024. DOI: 10.21468/SciPostPhysCodeb.39.

[6] 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.

[7] 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.

[8] 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.

[9] 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.

[10] 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.

[11] 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.

[12] 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.

[13] 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.

[14] 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.

[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.

[17] 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.

[18] 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.