

# Casey E. Berger

---

## Assistant Professor

Smith College  
Physics and Statistical and Data Sciences  
Northampton, MA 01060

Phone: (614) 439-6358  
Email: [cberger@smith.edu](mailto:cberger@smith.edu)  
Website: <https://www.caseyeberger.com/>

## Professional and Academic Positions

---

<b>Assistant Professor</b> Smith College Departments of Physics and Statistical and Data Sciences	July 2023- present
<b>Visiting Assistant Professor</b> Smith College Department of Physics	July 2021- July 2023
<b>Postdoctoral Research Associate</b> Boston University, Department of Physics and Hariri Institute for Computing	May 2020-May 2021
<b>Graduate Researcher</b> Advisor: Dr. Joaquín E. Drut The University of North Carolina at Chapel Hill	May 2015-May 2020
<b>DOE CSGF Practicum</b> Advisor: Dr. André Walker-Loud Lawrence Berkeley National Laboratory	May-August 2017
<b>Undergraduate Researcher</b> Advisors: Dr. Joaquín E. Drut, Dr. Richard J. Furnstahl, Dr. Robert J. Perry The University of North Carolina at Chapel Hill and The Ohio State University	Aug 2014-May 2015
<b>Computational Astronomy and Physics Summer REU Student</b> Advisors: Dr. Joaquín E. Drut, Dr. Eric R. Anderson The University of North Carolina at Chapel Hill	May 2014 - Aug 2014
<b>Undergraduate Researcher</b> Advisor: Dr. Christopher S. Hill The Ohio State University	Feb 2013-Feb 2014

## Education

---

<b>The University of North Carolina</b> Ph.D. in Physics, May 2020 <i>Royster Society of Fellows</i> <i>Department of Energy Computational Science Graduate Fellow</i> Dissertation: "Circumventing the sign problem in rotating quantum matter."	Chapel Hill, NC
<b>The Ohio State University</b> B.S. in Physics <i>summa cum laude</i> and with research distinction, May 2015 Cumulative GPA: 3.93	Columbus, OH
<b>Boston University</b> B.A. in Philosophy <i>summa cum laude</i> , May 2010 B.S. in Film Production <i>summa cum laude</i> , May 2010 Minor in Spanish Cumulative GPA: 3.80, <i>Phi Beta Kappa</i>	Boston, MA

## Research Grants as Principal Investigator

DOE ERCAP <i>Rotating superfluids via Complex Langevin</i>	2022
Department of Energy's Energy Research Computing Allocations Program grant. ERCAP0021439. Awarded resources: 3K CPU node hours, 100 GPU node hours, 1TB storage. Co-Investigator: Don Willcox.	
NSF XSEDE <i>Properties of rotating superfluids via the complex Langevin method</i>	2021
National Science Foundation Extreme Science and Engineering Discovery Environment grant. PHY200099. Awarded resources: 2k GPU hours, 50k core-hours, and 500GB storage on Bridges-2. Estimated value of awarded resources: \$25,105.70. Co-Investigator: Don Willcox.	
DOE ERCAP <i>Rotating superfluids via Complex Langevin</i>	2021
Department of Energy's Energy Research Computing Allocations Program grant. ERCAP0017942. Awarded resources: 17M NERSC hours, 270TB storage. Co-Investigators: Richard Brower, Don Willcox.	

## Publications and Preprints

<i>Quantum technologies for climate change: Preliminary assessment</i> , Q4Climate executive committee, white paper (2021)	
<i>Complex Langevin and other approaches to the sign problem in quantum many-body physics</i> , C. E. Berger, L. Rammelmüller, A. C. Loheac, F. Ehmman, J. Braun, and J. E. Drut, <i>Physics Reports</i> , (2020)	
<i>Thermodynamics of rotating quantum matter in the virial expansion</i> , C. E. Berger, K. J. Morrell, and J. E. Drut, <i>Phys. Rev. A</i> <b>102</b> , 023309 - (2020)	
<i>Third- and fourth-order virial coefficients of harmonically trapped fermions in a semiclassical approximation</i> , K. J. Morrell, C. E. Berger, and J. E. Drut, <i>Phys. Rev. A</i> <b>100</b> , 063626 - (2019)	
<i>Interacting Bosons at Finite Angular Momentum Via Complex Langevin</i> , C. E. Berger and J. E. Drut, <i>Proceedings of the 36th Annual International Symposium on Lattice Field Theory</i> (2019)	
<i>Hard-wall and non-uniform lattice Monte Carlo approaches to one-dimensional Fermi gases in a harmonic trap</i> , C. E. Berger, J. E. Drut, and W. J. Porter, <i>Computer Physics Communications</i> <b>208</b> , pp. 103-108 (2016)	
<i>Harmonically trapped fermions in two dimensions: ground-state energy and contact of SU(2) and SU(4) systems via nonuniform lattice Monte Carlo</i> , Z-H. Luo, C. E. Berger, and J. E. Drut, <i>Phys. Rev. A</i> <b>93</b> , 033604 - (2016)	
<i>Energy, contact, and density profiles of one-dimensional fermions in a harmonic trap via nonuniform-lattice Monte Carlo calculations</i> , C. E. Berger, E. R. Anderson, and J. E. Drut, <i>Phys. Rev. A</i> <b>91</b> , 053618 - (2015)	

## Conference Proceedings

<i>Quantum Counter-Terms for Lattice Field Theory on Curved Manifolds</i> , E. Owen, C. E. Berger, R. Brower, G. Fleming, Andrew D. Gasbarro, and Timothy G. Raben, <i>Proceedings of Science LATTICE 2021</i> , (2021)	
<i>Interacting Bosons at Finite Angular Momentum Via Complex Langevin</i> , C. E. Berger and J. E. Drut, <i>Proceedings of Science LATTICE 2018</i> , (2018)	

## Students Mentored

Meiqi Ma	Data science for quantum materials. <i>Smith College Class of 2027, AEMES program</i>
Libby Morningstar	Investigating Weyl semimetal and magnetized phases in quantum materials using stochastic and machine learning methods. <i>Smith College Class of 2023, Senior thesis</i>

## Students Mentored, cont'd

---

Jessica Jiang	Comparing approaches to the Ising Model. <i>Smith College Class of 2023</i>
Zoe Roumeliotis	Quantum data analysis <i>Smith College Class of 2024</i>
Allison Brand	Exploring Quantum mechanics through statistical models <i>Smith College Class of 2024</i>
Andy Esseln	Quantum data analysis <i>Smith College Class of 2025</i>
Kyara Soto Villareal	Quantum data analysis <i>Smith College Class of 2026</i>
AC Manning	Applying machine learning to determine thermalization of stochastic simulations. <i>Smith College Class of 2025, STRIDE program</i>
Jourbienthia Paul	Applying machine learning to determine thermalization of stochastic simulations. <i>Smith College Class of 2025, AEMES program</i>
Eloise Yang	Applications of the AMReX framework to improve computational efficiency in lattice algorithms. <i>Post-undergraduate researcher, Lawrence Berkeley National Laboratory</i>
Yasmine Zefri	Critical properties of nonequilibrium Ising models. <i>UNC Chapel Hill, Class of 2020</i>

## Teaching Experience

---

<i>Programming for Data Science in Python, instructor of record</i> Deep dive into data science packages in Python, including Numpy, Pandas, Seaborn, and Matplotlib. Object-oriented programming in Python and developing good practices for Python package development, with an emphasis on data wrangling, analysis, and visualization.	Fall 2023
<i>Reproducible Scientific Computing with Data, instructor of record</i> Lab-based course to teach good programming practices for data with R. Basic data wrangling and visualization, use of R studio and Markdown.	Fall 2023
<i>Mathematical Methods of Physical Sciences and Engineering, instructor of record</i> Overview of mathematical methods and their applications in Physics and Engineering. Recognizing, understanding, and applying mathematics to questions about the physical world, with hands-on work in Mathematica to develop numerical skills.	Fall 2022, Spring 2023
<i>Computational Methods for the Physical Sciences, instructor of record</i> Proposed and developed course in computational methods using Python, with no prior coding experience needed. From Python basics to error analysis, data management and visualization with pandas, numpy, and seaborn to implementing numerical algorithms for differentiation, integration, and stochastic systems.	Fall 2022
<i>Introductory Physics I, instructor of record</i> First course in the calculus-based introductory physics series at Smith College. Studio-style with combined lecture and lab. Newtonian mechanics, with an emphasis on problem-solving skills and critical reasoning about physics scenarios.	Fall 2021, Spring 2022

## Teaching Experience, cont'd

---

### *Advanced Data Structures, postdoctoral teaching assistant*

Assisted in online instruction for a computer engineering course at Boston University. Course covered searching and sorting, analysis of algorithms, trees and data structures, and 2D graphs and networks.

Fall 2020

### *Mathematical Methods of Theoretical Physics, Co-Instructor*

Co-instructor for a graduate course on mathematical methods for physics at UNC. Developed hands-on labs and exercises using simple coding tools.

Fall 2019

### *UNC First Year Seminar, instructor of record*

Developed and taught a 3 credit course on science literacy and communication to undergraduate students at UNC

Spring 2018

### *Senior Graduate Student Pre-Candidacy Mentoring Team:*

Held instructional sessions on content and test-taking strategies to help first year graduate students prepare for their qualifying exams

2017-2020

### *SciREN Triangle 2015:*

Developed a lesson plan for grades 6-12 based on statistical physics for use in local classrooms

Fall 2015

### *Private Tutor:*

High school and college physics, calculus, SAT prep, and Spanish

2012-2019

### *Teaching Assistant:*

Differential Equations for Scientists and Engineers

2013-2014

## Talks and Presentations

---

### Invited Talks

#### *Interdisciplinary methods for quantum materials*

Sigma Xi, Smith College

March 2023

*Teaching quantum physics to computers: the infinite improbability drive, statistical physics, and harnessing the questionable intelligence of machines*  
SciTech Café

March 2023

#### *Careers in Physics Panel Discussion*

CUWiP 2023, Boston University

January 2023

#### *What can a computer teach us about quantum physics?*

Hamilton College

December 2022

#### *What can a computer teach us about quantum physics?*

Smith College

November 2022

#### *Circumventing the sign problem with complex Langevin in lattice field theory*

FermiLab Theory Seminar

July 2020

#### *Circumventing the sign problem with complex Langevin in lattice field theory*

MIT Virtual Lattice Field Theory Colloquium Series

June 2020

**Invited Talks, cont'd**

<i>Circumventing the sign problem with complex Langevin in lattice field theory</i> RPI Advanced Cyberinfrastructure Training for Modeling Physical Systems	June 2020
<i>Complex Langevin: a method for overcoming the sign problem in lattice field theory</i> Harvey Mudd College	February 2020
<i>The complex Langevin approach to the sign problem in lattice field theory</i> Boston University High Energy Theory Seminar	January 2020
<i>Complex Langevin: a method for overcoming the sign problem in lattice field theory</i> Denison University	February 2020
<i>Complex Langevin: a method for overcoming the sign problem in lattice field theory</i> Oxford College of Emory University	November 2019
<i>Rotating Superfluids via Complex Langevin</i> The University of Glasgow	October 2019
<i>Rotating Superfluids via Complex Langevin</i> Lawrence Berkeley National Laboratory	October 2019
<i>Rotating Superfluids via Complex Langevin</i> Jefferson Laboratory	September 2019
<i>Complex Langevin in Nonrelativistic Rotating Bosonic Systems</i> Nuclear Theory Seminar: University of Maryland, College Park	October 2018

**Conference Talks**

<i>Complex Langevin in Nonrelativistic Rotating Bosonic Systems</i> 20th Conference on Recent Progress in Many Body Theories: Toulouse, France	September 2019
<i>Complex Langevin in Nonrelativistic Rotating Bosonic Systems</i> DOE CSGF Annual Program Review: Arlington, VA	July 2019
<i>Strongly interacting rotating bosons via complex stochastic quantization</i> Lattice 2018: East Lansing, MI	July 2018
<i>Strongly interacting rotating bosons via complex stochastic quantization</i> The American Physical Society March Meeting: Los Angeles, CA	March 2018
<i>Equation of state of strongly coupled 1D fermions in harmonic traps</i> The American Physical Society March Meeting: San Antonio, TX	March 2015
<i>Equation of state of strongly coupled 1D fermions in harmonic traps</i> Conference for Undergraduate Women in Physics: Ann Arbor, MI	January 2015
<i>Ground-state energy of interacting one-dimensional fermions in a harmonic trap: a new approach</i> Computational Astronomy and Physics REU: Chapel Hill, NC	August 2014

**Poster Presentations**

<i>Understanding rotating superfluids through statistical methods</i> UNC Women in Computing Research Symposium: Chapel Hill, NC	March 2019
<i>Strongly interacting rotating bosons via complex stochastic quantization</i> DOE CSGF Annual Program Review Fellows' Poster Session: Arlington, VA	July 2018
<i>Charged Pion Scattering with Massive QED</i> DOE CSGF Annual Program Review Fellows' Poster Session: Arlington, VA	July 2017
<i>Harmonically-trapped fermions in three dimensions: a hard-wall approach</i> DOE CSGF Annual Program Review Fellows' Poster Session: Arlington, VA	July 2016
<i>New quantum Monte Carlo method for determining the equation of state of one-dimensional fermions in harmonic traps</i> Denman Undergraduate Research Forum: The Ohio State University, Columbus, OH	March 2015
<i>The ground-state energy of interacting one-dimensional fermions in a harmonic trap: a new approach</i> Grace Hopper Celebration of Women in Computing REU Site Poster Session: Phoenix, AZ	October 2014
<i>The equation of state of one-dimensional fermions in a harmonic trap</i> Computational Astronomy and Physics REU poster session: Chapel Hill, NC	July 2014

**Conferences and Workshops: Organized**


---

Science Communication workshop for CUWiP 2023, Boston University	January, 2023
Work-Life Balance workshop for CUWiP 2023, Boston University	January, 2023
Quantum for Climate Workshop: virtual	February 2022
Third Annual Royster Global Conference: Chapel Hill, NC	May 2019
SciREN Triangle, 2015 - 2019	Sept. 2015, 2016, 2017, 2018, and 2019
SciREN Triangle Lesson Planning Workshop 2015-2019	Aug. 2015, 2016, 2017, 2018, and 2019

**Conferences and Workshops: Attended/Attending**


---

Data Science Education Community of Practice (DSECOP) Workshop	June 2023
NERSC/Nvidia AI for Science Bootcamp	August 2022
American Association of Physics Teachers New Faculty Workshop	July 2021
American Association of Physics Teachers North Carolina Section Fall Meeting	November 2019
20th Conference on Recent Progress in Many Body Theories: Toulouse, France	September 2019
Argonne Training Program on Extreme-Scale Computing (ATPESC): St. Charles, IL	July 2019

## Conferences and Workshops: Attended/Attending, Cont'd

DOE CSGF Annual Program Review: Arlington, VA	annually, 2016-present
UNC Course Development Institute for Graduate Students: Chapel Hill, NC	December 2017
STAQ Quantum Ideas Summer School: Duke University, Durham, NC	June 2019
Lattice 2018: East Lansing, MI	July 2018
American Physical Society March Meeting: Los Angeles, CA	March 2018
DOE CSGF Annual Program Review: Arlington, VA	July 2015
American Physical Society March Meeting: San Antonio, TX	March 2015
American Physical Society Conference for Undergraduate Women in Physics: Ann Arbor, MI	January 2015
Grace Hopper Celebration of Women in Computing: Phoenix, AZ	October 2014

## Professional Service

<b>Executive Committee Member-at-Large</b> American Physical Society's Topical Group on Data Science	2023-present
<b>Advisory Board Member</b> Qubit x Qubit	2021-present
<b>Creator and facilitator: Building Balance Webinar</b> MIT Women+ in Chemistry	2021
<b>Creator and facilitator: Resiliency and Work-Life Balance Webinar</b> Allies for Minorities and Women in Science and Engineering: UNC Chapel Hill	2020-2021
<b>Meetings and Seminar Development Chair</b> Allies for Minorities and Women in Science and Engineering: UNC Chapel Hill	2019-2020
<b>Organizational Team Member</b> SciREN (The Scientific Research and Education Network) Triangle	2015-2019
<b>Senior Graduate Student Pre-Candidacy Mentoring Team</b> UNC Department of Physics and Astronomy	2017- 2020
<b>Graduate Representative</b> Graduate Studies and Affairs Committee: UNC Department of Physics and Astronomy	Spring 2017
<b>Undergraduate Co-Chair</b> Society for Women in Physics: The Ohio State University	2013-2015
<b>Undergraduate Representative</b> Undergraduate Studies Committee: The Ohio State University	2013-2015

## Selected Honors and Awards

---

<i>William Neal Reynolds Fellow, Royster Society of Fellows</i> The University of North Carolina at Chapel Hill	Fall 2015 - Spring 2020
<i>Computational Science Graduate Fellow</i> The United States Department of Energy	Fall 2015 - Summer 2019
<i>NSF Graduate Research Fellowship Program - Honorable Mention</i> The National Science Foundation	Spring 2015
<i>Fulbright Award Finalist</i> The United States Department of State, Fulbright Commission	Spring 2015
<i>Smith Awards</i> Department of Physics, The Ohio State University	Spring 2015, 2014, & 2013
<i>Arts and Sciences Undergraduate Research Scholarship</i> The Ohio State University	Spring 2015
<i>Blue Chip Award</i> Boston University College of Communications	Spring 2010
<i>Matchette Prize for Excellence in Philosophy</i> Department of Philosophy, Boston University College of Arts and Sciences	Spring 2010

## Professional and Academic Society Memberships

---

The American Association for Physics Teachers (AAPT)  
 The American Physical Society (APS)  
 Sigma Pi Sigma Physics Honor Society  
 Mortar Board National Senior Honorary

## Reviewer for

---

*Physical Review A*  
*Foundations of Physics*

## Skills

---

**Programming Languages:** C++, Python, Mathematica, LaTeX, R  
**Programming Packages and Libraries:** OpenMP, Jupyter, Numpy, Pandas, Seaborn, PyTorch  
**Programming Skills and Competencies:** SLURM job submission, shared compute systems, cloud computing  
**Languages:** English (fluent), Spanish (fluent), French (conversational)



## Non-academic Employment

---

### **Management 360**

Beverly Hills, CA

*Assistant to literary manager*, October 2010-February 2012

Working busy desks, dealing with high-profile clients: sending out submissions, handling client and manager calendars, answering phones and rolling calls, organizing travel.

Script analysis and project work: reading scripts and writing coverage, developing director and casting ideas lists for projects.