Eric J. Meier, Ph.D.

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Education

Ph.D. physics **2019**
The University of Illinois at Urbana-Champaign
Thesis: *Momentum-Space Lattices for Ultracold Atoms*, Advisor: Bryce Gadway

B.S. physics, cum laude **2014**
Denison University. Granville, Ohio
Thesis: *Statistical Modeling of Jets in Active Galactic Nuclei*, Advisor: Dan Homan

Research

Professional

Scientist, Quantum Group, MPA **2023–Present**
Los Alamos National Laboratory
I work on a myriad of projects in quantum information science using experimental atomic physics.

Postdoctoral

Director's Postdoctoral Fellow, MPA–Q **2021–2023**
Los Alamos National Laboratory
I primarily worked toward building apparatuses for quantum computing and sensing with ultracold rubidium and strontium atoms.

Postdoctoral Research Associate, Gadway/DeMarco Lab **2019–2021**
The University of Illinois at Urbana-Champaign
I worked with three different teams in the lab. (1) My primary role was the construction of a ground state sodium-rubidium molecule apparatus for use in quantum information experiments. (2) I built a system that uses potassium Rydberg atoms trapped in optical tweezers for analog quantum simulation experiments. (3) I helped in a mentorship role on the Bose–Einstein condensate apparatus I constructed as part of my graduate work.

Graduate

Research Assistant, Advisor: Bryce Gadway **2014–2019**
The University of Illinois at Urbana-Champaign
As the first graduate student in the Gadway Lab, I built and operated a rubidium Bose–Einstein condensate apparatus that engineered synthetic lattices of atomic momentum-states for the analog quantum simulation of condensed matter phenomena.

Undergraduate

Researcher, Advisor: Steven Olmschenk **2014**
Denison University. Granville, Ohio
I worked toward building a trapped ion quantum computing system using lanthanum ions.

Researcher, Advisor: Dan Homan **2012–2014**
Denison University. Granville, Ohio
I wrote computer simulations of relativistic extragalactic jets in an effort to match typical observed acceleration profiles found in the MOJAVE program database.

Skills

Experimental Physics Skills

Laser Operation, Alignment, & Locking • Vacuum Chamber Assembly & Baking • Laser Safety Interlock Design and Implementation • Experimental Optimization with Machine Learning • Electromagnet Design & Control (including high-fields for Feshbach Resonances) • Optical Fibers/Fiber Coupling/Fiber Splicing • Data Analysis • Computer Simulation • Basic Electronics Design • Surface-Mount and Through-Hole Soldering • Atomic Spectroscopy Techniques (Saturated Absorption, Polarization, Modulation Transfer) • Resonant Atomic Imaging • 2D and 3D Magneto-Optical Trapping • Optical Pumping • Optical Molasses • Optical Dipole Trapping & Evaporation • Bose–Einstein Condensation • Two-Species Mixtures • Light-Induced Atomic Desorption • Digital Micromirror Devices & Spatial Light Modulators • Active Optical Elements (Tapered Amplifiers, Acousto- and Electro-Optic Modulators, Shutters, Raman Fiber Amplifiers) • Radio-Frequency Source Design and Implementation • Optical Cavity Laser Locking • Basic Woodworking & Machining

Computer Skills & Languages

Adobe Photoshop & Illustrator • Wolfram Mathematica • Matlab • Python • LabVIEW & LabVIEW FPGA • 3D Modeling and Design in Solidworks • Andor Basic • Microsoft Office • Computer Assembly • LaTeX • American Sign Language (beginner)

Soft Skills

Flexibility • Effective and Clear Communication • Attention to Detail • Teamwork & Cooperation • Time Management • Internal Motivation

Publications

Selected

13. *Observation of the topological Anderson insulator in disordered atomic wires*
Eric. J. Meier, Fangzhao Alex An, Alexandre Dauphin, Maria Maffei, Pietro Massignan, Taylor L. Hughes, and Bryce Gadway.
Science **362**, 6417 (2018)
    - selected for a research highlight in Nature Physics

12. *Observation of the topological soliton state in the Su-Schrieffer-Heeger model*
Eric J. Meier, Fangzhao Alex An, and Bryce Gadway.
Nature Communications **7**, 13986 (2016)

11. *Atom-optics simulator of lattice transport phenomena*
Eric J. Meier, Fangzhao Alex An, and Bryce Gadway.
Physical Review A **93**, 051602(R) (2016)

Other

10. *Qudit entanglers using quantum optimal control*
Sivaprasad Omanakuttan, Anupam Mitra, **Eric J. Meier**, Michael J. Martin, Ivan H. Deutsch.
PRX Quantum 4, 040333 (2023)
9. *Nonlinear Dynamics in a Synthetic Momentum-State Lattice*
Fangzhao Alex An, Bhuvanesh Sundar, Junpeng Hou, Xi-Wang Luo, **Eric J. Meier**, Chuanwei Zhang, Kaden R. A. Hazzard, and Bryce Gadway.
Physical Review Letters **127**, 130401 (2021)
    - selected as *Editor's Suggestion*
8. *Interactions and Mobility Edges: Observing the Generalized Aubry-André Model*
Fangzhao Alex An, Karmela Padavić, **Eric J. Meier**, Suraj Hegde, Sriram Ganeshan, J. H. Pixley, Smitha Vishveshwara, and Bryce Gadway.
Physical Review Letters **126**, 040603 (2021)
    - selected as *Editor's Suggestion*
7. *Nondestructive dispersive imaging of rotationally excited ultracold molecules*
Qingze Guan, Michael Highman, **Eric J. Meier**, Garrett R. Williams, Vito Scarola, Brian DeMarco, Svetlana Kotochigova, and Bryce Gadway.
Physical Chemistry Chemical Physics **22**, 20531 (2020)
6. *Counterdiabatic control of transport in a synthetic tight-binding lattice*
Eric J. Meier, Kinfung Ngan, Dries Sels, and Bryce Gadway.
Physical Review Research **2**, 043201 (2020)
    - selected as *Editor's Suggestion*
5. *Exploring quantum signatures of chaos on a Floquet synthetic lattice*
Eric J. Meier*, Jackson Ang'ong'a*, Fangzhao Alex An, and Bryce Gadway.
Physical Review A **100**, 013623 (2019)
    - selected as *Editor's Suggestion*
4. *Engineering a flux-dependent mobility edge in disordered zigzag chains*
Fangzhao Alex An, **Eric J. Meier**, and Bryce Gadway.
Physical Review X **8**, 031045 (2018)
3. *Correlated dynamics in a synthetic lattice of momentum states*
Fangzhao Alex An, **Eric J. Meier**, Jackson Ang'ong'a, and Bryce Gadway.
Physical Review Letters **120**, 040407 (2018)
2. *Diffusive and arrested transport of atoms under tailored disorder*
Fangzhao Alex An, **Eric J. Meier**, and Bryce Gadway.
Nature Communications **8**, 325 (2017)
1. *Direct observation of chiral currents and magnetic reflection in atomic flux lattices*
Fangzhao Alex An, **Eric J. Meier**, and Bryce Gadway.
Science Advances **3**, e1602685 (2017)

Presentations

Oral Presentations

6. Air Force Research Lab and Sandia Technical Exchange Seminar (invited)
   Neutral Atom Quantum Information Science
   July 2023 virtual
5. BEC2018X (invited)
   Quantum simulation of one-dimensional topological insulators with cold atoms
   December 2018 at the University of Tsukuba in Tokyo, Japan
4. Midwest Cold Atom Workshop 2017 (invited)
   Correlated phenomena in synthetic momentum-space lattices
   November 2017 at the University of Michigan in Ann Arbor, Michigan
3. DAMOP 2019, Session: "Dynamics of Cold Atoms in Optical Lattices"
   Fast eigenstate preparation in a synthetic lattice by counter-diabatic driving
   May 2019 in Milwaukee, Wisconsin
2. DAMOP 2017, Session: "New Topological Quantum Matter"
   Disordered topological wires in a momentum-space lattice
   June 2017 in Sacramento, California
1. DAMOP 2016, Session: "Progress in Spin-Orbit Coupling"
   Direct observation of edge states in the Su–Schrieffer–Heeger model with bosonic atoms in a momentum space lattice
   May 2016 in Providence, Rhode Island

Posters

8. DAMOP 2023
   Experimental progress towards quantum control of strontium qudits
   June 2023 at in Spokane, Washington
7. Midwest Cold Atom Workshop 2019
   Evidence for the topological Anderson insulator
   November 2019 at Northwestern University in Evanston, Illinois
6. International Conference on Atomic Physics 2018
   Evidence for the topological Anderson insulator
   July 2018 in Barcelona, Spain
5. Midwest Cold Atom Workshop 2017
   Disordered topological wires
   November 2017 at the University of Michigan in Ann Arbor, Michigan
4. DAMOP 2017
   Disordered wires and quantum chaos in a momentum-space lattice
   June 2017 in Sacramento, California
3. Midwest Cold Atom Workshop 2016
   Quantum simulation of topological wires
   October 2016 at the University of Chicago in Chicago, Illinois

2. DAMOP 2016
   Atom optics simulator of lattice transport phenomena
   May 2016 in Providence, Rhode Island

1. Midwest Cold Atom Workshop 2015
   Towards studying topological matter with cold atoms in optical lattices
   November 2015 at the University of Wisconsin at Madison

Honors and Awards

2021: Director's Postdoctoral Fellow, Los Alamos National Laboratory
- based on academic and research accomplishments, the strength of the proposed research, as well as their potential impact at the Laboratory

2018: Drickamer Research Fellowship, University of Illinois at Urbana-Champaign
- a graduate fellowship awarded to a student who has demonstrated significant ability in research

2016: Scott Anderson Award, University of Illinois at Urbana-Champaign
- recognizes the year's outstanding physics graduate teaching or research assistants

2014: Samuel C. Wheeler Award for Excellence in Physics, Denison University
- excellence in the understanding and doing of physics combined with leadership in the department

2012, 2013: Physics Department Fellow, Denison University

2012: Inducted, Sigma Pi Sigma National Physics Honor Society

2012, 2013: Anderson Summer Research Assistantship Award, Denison University
- funding for summer-term research awarded to excellent proposals in all fields of science

2012: Ron Winters Emeritus Faculty Scholar Award, Denison University
- outstanding undergraduate physics research

2011: Excellence in Introductory Physics Award, Denison University

2009: Boy Scouts of America Eagle Scout Award. Troop 11, Kingsville, Ohio

Teaching

Graduate

Teaching Assistant, College Physics: E&M & Modern **2018, 2019**
The University of Illinois at Urbana-Champaign
I taught small class sections (30 students) in this second introductory physics course for non-majors.
- Ranked 'Excellent Teacher' based on student evaluations

Teaching Assistant, Introductory Mechanics **2014**
The University of Illinois at Urbana-Champaign
I taught small class sections (30 students) in this introductory physics course for physics majors.
- Ranked 'Excellent Teacher' based on student evaluations

Undergraduate

Laboratory Teaching Assistant, Introductory Astronomy **2013–2014**
Denison University. Granville, Ohio
In addition to teaching students how to use reflecting and refracting telescopes and aiding them in their observations, I was in charge of telescope assembly, disassembly, and storage.

Laboratory Teaching Assistant, Introductory Physics **2012–2014**
Denison University. Granville, Ohio
Working in conjunction with the course's professor, I facilitated students in performing their experiments.

University Tutor **2011–2014**
Denison University. Granville, Ohio