

# Philip J. Richerme

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## EDUCATION

- 2012 Ph.D., Physics, Harvard University
- 2008 M.A., Physics, Harvard University
- 2006 S.B., Physics (Music minor), Massachusetts Institute of Technology

## POSITIONS AND APPOINTMENTS

- 2022- Associate Professor of Physics, Indiana University, Bloomington IN
- 2015-22 Assistant Professor of Physics, Indiana University, Bloomington IN
- 2014-15 Senior Research Scientist, Joint Quantum Institute, College Park MD  
Principal Investigator: Christopher Monroe
- 2012-14 Postdoctoral Fellow, Joint Quantum Institute, College Park MD  
Principal Investigator: Christopher Monroe
- 2006-12 Graduate research assistant, Harvard University, Cambridge MA  
Advisor: Gerald Gabrielse

## GRANTS AND COMPUTING TIME

- 2023 **Chemically-Inspired, Tunable Quantum Computing Architectures for Dynamics of Molecular Systems**  
Lead-PI; Award Total: \$300,000 (PI share: \$183,815); 6/1/2023-5/31/2025  
National Science Foundation, EAGER: Chemical Theory, Models, and Computation
- 2023 **Scalable integration of ion-photon quantum information converters on fiber for networking and computing applications**  
Co-PI; Award Total: \$300,000 (PI share: \$130,000); 6/1/2023-5/31/2025  
National Science Foundation, EAGER: Quantum Manufacturing
- 2022 **IUCRC Phase I Indiana University: Center for Quantum Technologies (CQT)**  
Co-PI; Award Total: \$600,000; 9/1/2022-8/31/2027  
National Science Foundation, Industry-University Coop. Research Centers Program
- 2022 **Benchmarking Quantum Chemical Nuclear Dynamics problems on the QSCOUT Trapped-Ion Testbed**  
Lead-PI; Quantum Computing Time Awarded: 100 hours; 11/1/2022-10/31/2023  
Department of Energy, Sandia National Labs, QSCOUT Quantum Testbed
- 2021 **Indiana University National Security Academic Accelerator: Artificial Intelligence and Quantum Information Science Technical Foci for National Defense**  
Co-PI; Award Total: \$500,000 (PI share: \$225,000); 9/1/2021-8/31/2022  
Department of Defense, National Security Innovation Network/EMERGE
- 2021 **Simulating Quantum Chemical Nuclear Dynamics problems on the QSCOUT Trapped-Ion Testbed**  
Lead-PI; Quantum Computing Time Awarded: 100 hours; 11/1/2021-10/31/2022  
Department of Energy, Sandia National Labs, QSCOUT Quantum Testbed

- 2021 **Simulating the Quantum Nuclear Dynamics of Protonated Water Clusters on the IonQ Trapped-Ion Processor**  
Lead-PI; Award Total: \$10,000; 8/1/2021-12/31/2021  
IonQ Academic Research Credits Program
- 2021 **IUCRC Planning Grant: Indiana University Center for Quantum Technologies**  
Co-PI; Award Total: \$20,000; 5/1/2021-4/30/2022  
National Science Foundation, Industry-University Coop. Research Centers Program
- 2020 **Indiana University National Security Academic Accelerator: Artificial Intelligence and Quantum Information Science Technical Foci for National Defense**  
Co-PI; Award Total: \$500,000 (PI share: \$225,000); 9/1/2020-8/31/2021  
Department of Defense, National Security Academic Accelerator
- 2020 **Simulating Proton-coupled electron transfer problems on the QSCOUT Trapped-Ion Testbed**  
Lead-PI; Quantum Computing Time Awarded: 100 hours; 11/1/2020-10/31/2021  
Department of Energy, Sandia National Labs, QSCOUT Quantum Testbed
- 2020 **Investigating Radiation Effects in a Trapped-Ion Quantum Information Processor**  
Lead-PI; Award Total: \$60,000 (PI share: \$60,000); 5/1/2020-9/30/2020  
Department of Defense, Naval Surface Warfare Center Crane
- 2019 **Simulating Entangled Quantum Chemical Abstract Machines**  
Co-PI; Award Total: \$1,994,238 (PI share: \$560,167); 9/1/2019-8/31/2023  
National Science Foundation, QII-TAQS Program
- 2019 **An Ion-Trap Quantum Simulator for Exotic 2D Materials**  
Lead-PI; Award Total: \$900,000 (PI share: \$453,437); 9/15/2019-9/14/2022  
U.S. Department of Energy, Basic Energy Sciences Program
- 2018 **Center for Quantum Science and Engineering**  
Co-PI; Award Total: \$3,000,000; 5/1/2018-4/30/2022  
Indiana University Emerging Areas of Research
- 2016 **Programmable 2D Arrays of Interacting Quantum Spins Using Trapped Ions**  
Lead-PI; Award Total: \$360,000 (PI share: \$360,000); 6/15/2016-6/14/2020  
Air Force Office of Scientific Research, Young Investigator Program

## **AWARDS**

- 2021 Indiana University Trustees Teaching Award
- 2021 Indiana University Physics Dept. Outstanding Undergraduate Teaching Award
- 2020 Indiana University Physics Dept. Outstanding Undergraduate Teaching Award
- 2019 Indiana University Trustees Teaching Award
- 2019 Univ. of Maryland Invention of the Year: "Cryogenic Ion Trapping and Storage System for Quantum Information Processing"
- 2016 Indiana University Trustees Teaching Award
- 2016 Indiana University Physics Dept. Outstanding Undergraduate Teaching Award
- 2012 Presidential Management Fellow
- 2012 NRC Postdoctoral Fellowship (declined)
- 2009 Harvard Physics Dept. Certificate of Distinction in Teaching

2006-8 National Defense Science & Engineering Graduate Fellowship

## **PUBLICATIONS, PATENTS, AND PRESENTATIONS**

### REFEREED JOURNALS AND PREPRINTS:

39. **Measurement-Induced Heating of Trapped Ions**  
A.J. Rasmusson, I. Jung, F. Schroer, A. Kyprianidis, and P. Richerme  
[arXiv: 2404.09327 \(2024\)](#)
38. **NISQ Quantum Computing: A Security-Centric Tutorial and Survey**  
F. Chen, L. Jiang, H. Mueller, P. Richerme, C. Chu, Z. Fu, and M. Yang  
[IEEE Circuits and Systems \*\*24\*\*, 14 \(2024\)](#)
37. **Interaction Graph Engineering in Trapped-Ion Quantum Simulators with Global Drives**  
A. Kyprianidis, A. J. Rasmusson, and P. Richerme  
[New Journal of Physics \*\*26\*\*, 023033 \(2024\)](#)
36. **A Hybrid Quantum-Classical Neural Network for Learning Transferable Visual Representation**  
R. Wang, P. Richerme, and F. Chen  
[Quantum Science and Technology \*\*8\*\*, 045021 \(2023\)](#)
35. **Quantum Computation of Hydrogen Bond Dynamics and Vibrational Spectra**  
P. Richerme, M. C. Reville, C. G. Yale, D. Lobser, A. D. Burch, S. M. Clark, D. Saha, M. A. Lopez-Ruiz, A. Dwivedi, J. M. Smith, S. A. Norrell, A. Sabry, and S. S. Iyengar  
[J. Phys. Chem. Lett. \*\*14\*\*, 7256 \(2023\)](#)
34. **Mapping Quantum Chemical Dynamics Problems Onto Spin-Lattice Simulators**  
D. Saha, S. S. Iyengar, P. Richerme, J. M. Smith, and A. Sabry  
[J. Chem. Theory Comput. \*\*17\*\*, 6713 \(2021\).](#)
33. **Optimized Pulsed Sideband Cooling and Enhanced Thermometry of Trapped Ions**  
A.J. Rasmusson, M. D'Onofrio, Y. Xie, J. Cui, and P. Richerme  
[Phys. Rev. A \*\*104\*\*, 043108 \(2021\).](#)
32. **An Open-Endcap Blade Trap for Radial-2D Ion Crystals**  
Y. Xie, J. Cui, M. D'Onofrio, A.J. Rasmusson, S. Howell, and P. Richerme  
[Quantum Science and Technology \*\*6\*\*, 044009 \(2021\).](#)
31. **Susceptibility of Trapped-Ion Qubits to Low-Dose Radiation Sources**  
J. Cui, A.J. Rasmusson, M. D'Onofrio, Y. Xie, E. Wolanski, and P. Richerme  
[J. Phys. B: At. Mol. Opt. Phys. \*\*54\*\*, 13LT01 \(2021\).](#)
30. **Floquet Gauge Pumps as Sensors for Spectral Degeneracies Protected by Symmetry or Topology**  
A. Kumar, G. Ortiz, P. Richerme, and B. Seradjeh  
[Phys. Rev. Lett. \*\*126\*\*, 206602 \(2021\)](#)

29. **Programmable Quantum Simulations of Spin Systems with Trapped Ions**  
C. Monroe, W. C. Campbell, L.-M. Duan, Z.-X. Gong, A. V. Gorshkov, P. Hess, R. Islam, K. Kim, G. Pagano, P. Richerme, C. Senko, and N. Y. Yao  
[Rev. Mod. Phys. \*\*93\*\*, 025001 \(2021\)](#)
28. **Radial two-dimensional ion crystals in a linear Paul trap**  
M. D'Onofrio, Y. Xie, A.J. Rasmusson, E. Wolanski, J. Cui, and P. Richerme  
[Phys. Rev. Lett. \*\*127\*\*, 020503 \(2021\)](#)
27. **Cryogenic Trapped-Ion System for Large Scale Quantum Simulation**  
G. Pagano, P. W. Hess, H. B. Kaplan, W. L. Tan, P. Richerme, P. Becker, A. Kyprianidis, J. Zhang, E. Birckelbaw, M. R. Hernandez, Y. Wu, and C. Monroe  
[Quantum Sci. Technol. \*\*4\*\*, 014004 \(2018\)](#).
26. **Non-thermalization in trapped atomic ion spin chains**  
P. W. Hess, P. Becker, H. Kaplan, A. Kyprianidis, A. C. Lee, B. Neyenhuis, G. Pagano, P. Richerme, C. Senko, J. Smith, W. L. Tan, J. Zhang, and C. Monroe  
[Phil. Trans. R. Soc. A \*\*375\*\*: 20170107 \(2017\)](#).
25. **Observation of Prethermalization in Long-Range Interacting Spin Chains**  
B. Neyenhuis, J. Smith, A. C. Lee, J. Zhang, P. Richerme, P. W. Hess, Z.-X. Gong, A. V. Gorshkov, and C. Monroe  
[Science Adv. \*\*3\*\*, e1700672 \(2017\)](#).
24. **Long-range Heisenberg models in quasi-periodically driven crystals of trapped ions**  
A. Bermudez, L. Tagliacozzo, G. Sierra, and P. Richerme  
[Phys. Rev. B \*\*95\*\*, 024431 \(2017\)](#).
23. **Viewpoint: How to Create a Time Crystal**  
P. Richerme  
[Physics \*\*10\*\*, 5 \(2017\)](#).
22. **Engineering large Stark shifts for control of individual clock state qubits**  
A. C. Lee, J. Smith, P. Richerme, B. Neyenhuis, P. W. Hess, J. Zhang, and C. Monroe  
[Phys. Rev. A \*\*94\*\*, 042308 \(2016\)](#).
21. **Two-dimensional ion crystals in radio-frequency traps for quantum simulation**  
P. Richerme  
[Phys. Rev. A \*\*94\*\*, 032320 \(2016\)](#).
20. **Many-body localization in a quantum simulator with programmable random disorder**  
J. Smith, A. Lee, P. Richerme, B. Neyenhuis, P.W. Hess, P. Hauke, M. Heyl, D. Huse, and C. Monroe.  
[Nature Physics \*\*12\*\*, 907 \(2016\)](#).
19. **String order via Floquet interactions in atomic systems**  
T. E. Lee, Y. N. Joglekar, and P. Richerme  
[Phys. Rev. A \*\*94\*\*, 023610 \(2016\)](#).

18. **Kaleidoscope of quantum phases in a long-range interacting spin-1 chain**  
Z.-X. Gong, M. F. Maghrebi, A. Hu, M. Foss-Feig, P. Richerme, C. Monroe, and A. V. Gorshkov  
[Phys. Rev. B \*\*93\*\*, 205115 \(2016\).](#)
17. **Large numbers of cold positronium atoms created in laser-selected Rydberg states using resonant charge exchange**  
R. McConnell, G. Gabrielse, W. S. Kolthammer, P. Richerme, A. Müllers, J. Walz, D. Grzonka, M. Zielinski, D. Fitzakerley, M. C. George, E. A. Hessels, C. H. Storry, and M. Weel  
[J. Phys. B: At. Mol. Opt. Phys. \*\*49\*\*, 064002 \(2016\).](#)
16. **Simulating the Haldane phase in trapped-ion spins using optical fields**  
I Cohen, P. Richerme, Z.-X. Gong, C. Monroe, and A. Retzker  
[Phys. Rev. A \*\*92\*\*, 012334 \(2015\).](#)
15. **Realization of a Quantum Integer-Spin Chain with Controllable Interactions**  
C. Senko, P. Richerme, J. Smith, A. Lee, I. Cohen, A. Retzker, and C. Monroe.  
[Phys. Rev. X. \*\*5\*\*, 021026 \(2015\).](#)
14. **Non-local propagation of correlations in quantum systems with long-range interactions**  
P. Richerme, Z.-X. Gong, A. Lee, C. Senko, J. Smith, M. Foss-Feig, S. Michalakias, A. V. Gorshkov, and C. Monroe.  
[Nature \*\*511\*\*, 198 \(2014\).](#)
13. **Coherent Imaging Spectroscopy of a Quantum Many-Body Spin System**  
C. Senko, J. Smith, P. Richerme, A. Lee, W. C. Campbell, and C. Monroe.  
[Science \*\*345\*\*, 430 \(2014\).](#)
12. **Quantum Catalysis of Magnetic Phase Transitions in a Quantum Simulator**  
P. Richerme, C. Senko, S. Korenblit, J. Smith, A. Lee, R. Islam, W. C. Campbell, and C. Monroe.  
[Phys. Rev. Lett. \*\*111\*\*, 100506 \(2013\).](#)
11. **Experimental Performance of a Quantum Simulator: Optimizing Adiabatic Evolution and Identifying Many-Body Ground States**  
P. Richerme, C. Senko, J. Smith, A. Lee, and C. Monroe.  
[Phys. Rev. A. \*\*88\*\*, 012334 \(2013\).](#)
10. **Using electric fields to prevent mirror-trapped antiprotons in antihydrogen studies**  
P. Richerme, G. Gabrielse, S. Ettenauer, R. Kalra, E. Tardiff, D.W. Fitzakerley, M.C. George, E.A. Hessels, C.H. Storry, M. Weel, A. Müllers, and J. Walz.  
[Phys. Rev. A. \*\*87\*\*, 023422 \(2013\).](#)

9. **Trapped Antihydrogen in Its Ground State**  
G. Gabrielse, R. Kalra, W.S. Kolthammer, R. McConnell, P. Richerme, D. Grzonka, W. Oelert, T. Seifick, M. Zielinski, D.W. Fitzakerley, M.C. George, E.A. Hessels, C.H. Storry, M. Weel, A. Müllers, and J. Walz.  
[Phys. Rev. Lett. \*\*108\*\*, 113002 \(2012\).](#)
8. **A semiconductor laser system for production of antihydrogen**  
A. Müllers, S. Böttner, D. Kolbe, T. Diehl, A. Koglbauer, M. Sattler, M. Stappel, R. Steinborn, J. Walz, G. Gabrielse, R. Kalra, W.S. Kolthammer, R. McConnell, P. Richerme, D.W. Fitzakerley, M.C. George, E.A. Hessels, C.H. Storry, M. Weel, D. Grzonka, and W. Oelert.  
[New J. Phys. \*\*14\*\*, 055009 \(2012\).](#)
7. **Efficient transfer of positrons from a buffer-gas-cooled accumulator into an orthogonally-oriented superconducting magnet for antihydrogen studies**  
D. Comeau, A. Dror, D.W. Fitzakerley, M.C. George, E.A. Hessels, C.H. Storry, M. Weel, D. Grzonka, W. Oelert, G. Gabrielse, R. Kalra, W.S. Kolthammer, R. McConnell, P. Richerme, A. Müllers, and J. Walz.  
[New J. Phys. \*\*14\*\*, 045006 \(2012\).](#)
6. **Adiabatic Cooling of Antiprotons**  
G. Gabrielse, W.S. Kolthammer, R. McConnell, P. Richerme, R. Kalra, E. Novitski, D. Grzonka, W. Oelert, T. Seifick, M. Zielinski, D. Fitzakerley, M.C. George, E.A. Hessels, C.H. Storry, M. Weel, A. Müllers, and J. Walz.  
[Phys. Rev. Lett. \*\*106\*\*, 073002 \(2011\).](#)
5. **Pumped helium system for cooling positron and electron traps to 1.2 K**  
J. Wrubel, G. Gabrielse, W.S. Kolthammer, P. Laroche, R. McConnell, P. Richerme, D. Grzonka, W. Oelert, T. Seifick, M. Zielinski, J.S. Borbely, M.C. George, E.A. Hessels, C.H. Storry, M. Weel, A. Müllers, J. Walz, and A. Speck.  
[Nuc. Inst. and Meth. A, \*\*640\*\*, 232 \(2011\).](#)
4. **Centrifugal Separation of Antiprotons and Electrons**  
G. Gabrielse, W.S. Kolthammer, R. McConnell, P. Richerme, J. Wrubel, R. Kalra, E. Novitski, D. Grzonka, W. Oelert, T. Seifick, M. Zielinski, D. Fitzakerley, M.C. George, E.A. Hessels, C.H. Storry, M. Weel, A. Müllers, J. Walz, and A. Speck.  
[Phys. Rev. Lett. \*\*105\*\*, 213002 \(2010\).](#)
3. **Antihydrogen Production Within a Penning-Ioffe Trap**  
G. Gabrielse, P. Laroche, D. Le Sage, B. Levitt, W.S. Kolthammer, R. McConnell, P. Richerme, J. Wrubel, A. Speck, M.C. George, D. Grzonka, W. Oelert, T. Seifick, Z. Zhang, A. Carew, D. Comeau, E.A. Hessels, C.H. Storry, M. Weel, and J. Walz.  
[Phys. Rev. Lett. \*\*100\*\*, 113001 \(2008\).](#)
2. **Loading and Characterization of a Printed Circuit Board Atomic Ion Trap**  
K. R. Brown, R. J. Clark, J. Labaziewicz, P. Richerme, D. R. Leibbrandt, and I. L. Chuang.  
[Phys. Rev. A. \*\*75\*\*, 015401 \(2007\).](#)

1. **A Compact, Filtered Diode Laser System for Precision Spectroscopy**  
J. Labaziewicz, P. Richerme, K. R. Brown, I. L. Chuang, and K. Hayasaka.  
[Optics Lett. 32, 572 \(2007\).](#)

PATENTS:

1. U.S. Patent 10998163, "Cryogenic Trapped-Ion System," May 4, 2021  
Inventors: C. Monroe, G. Pagano, P. W. Hess, H. B. Kaplan, W. L. Tan, P. Richerme

INVITED TALKS:

- 06/2023 APS DAMOP Meeting, Spokane, WA  
"Quantum Computation of Hydrogen Bond Dynamics and Vibrational Spectra"
- 04/2023 Sandia Quantum Science Colloquium, Sandia National Labs, Albuquerque, NM  
"Quantum Computation of Hydrogen Bond Dynamics and Vibrational Spectra"
- 01/2023 SPIE Photonics West, San Francisco, CA  
"Quantum Computation of Hydrogen Bond Dynamics and Vibrational Spectra"
- 10/2022 Indiana University Physics Colloquium, Bloomington, IN  
"The Second Quantum Revolution and the 2022 Nobel Prize in Physics"
- 08/2022 North American Conference on Trapped Ions, Duke University, Raleigh, NC  
"Ion Trap Quantum Simulations of Hydrogen Bond Dynamics"
- 06/2022 ASIC Cognitive Science Conference, Chamonix, France  
"Quantum Information Processing: Now and To Come"
- 03/2022 QSCOUT Exchange Workshop, Albuquerque, NM (Virtual)  
"Quantum Computation of Hydrogen Bond Dynamics and Vibrational Spectra"
- 03/2022 APS March Meeting, Chicago, IL  
"2D Ion Qubit Arrays for Quantum Information Processing"
- 02/2022 Indiana University Physical Chemistry Seminar, Bloomington, IN  
"Quantum Computation of Hydrogen Bond Dynamics and Vibrational Spectra"
- 12/2021 DOE Workshop on Quantum Computing Testbeds, Germantown, MD (Virtual)  
"Simulating Quantum Chemical Dynamics on the QSCOUT Quantum Testbed"
- 10/2021 Center for Quantum Technologies Workshop, West Lafayette, IN  
"Quantum-Enabled Materials and Chemical Design"
- 08/2021 Indiana University Physics Colloquium, Bloomington, IN  
"Quantum Simulation of Materials and Chemical Systems Using Trapped Ion Arrays"
- 04/2021 Department of Defense Basic Research Forum, Arlington, VA (Virtual)  
"Arrays of Trapped Ions as a Portable Quantum Information Platform"
- 03/2021 Physics Colloquium, Univ. of Kentucky, Lexington, KY (Virtual)  
"2D Arrays of Trapped Ions for Quantum Simulation"

- 02/2020 Entangled Sensing Workshop, West Lafayette, IN (Virtual)  
"2D Arrays of Trapped Ions for Entangled Quantum Matter"
- 01/2020 Denison University Physics Colloquium, Granville, OH  
"2D Quantum Simulation with Trapped Atomic Ions"
- 11/2019 DOE Workshop on Fossil Energy and Quantum Information, Pittsburgh, PA  
"Quantum Simulation of Materials and Chemistry with Trapped Atomic Ions"
- 02/2019 Quantum Science Workshop, Purdue University, West Lafayette, IN  
"Quantum Simulation of Interacting Spin Systems Using Trapped Ions"
- 01/2019 Indiana University Physics Colloquium, Bloomington, IN  
"The Second Quantum Revolution: Exploiting Entanglement"
- 12/2018 Naval Surface Warfare Center Crane, Crane, IN  
"Making Heads and Tails of Quantum Information"
- 06/2018 Air Force Office of Scientific Research Program Review, Arlington, VA.  
"Programmable 2D Arrays of Interacting Quantum Spins Using Trapped Ions"
- 03/2018 UCLA Atomic Physics Seminar, Los Angeles, CA  
"Quantum Simulation of Interacting Spin Systems Using Trapped Ions"
- 08/2017 North American Conference on Trapped Ions, NIST, Boulder, CO  
"Quantum Simulation of 2D Spin Systems Using Trapped Ions"
- 04/2017 Quantum Information and Measurement IV, Paris, France  
"Interacting Many-Body Spin Systems that Fail to Quantum Thermalize"
- 03/2017 APS March Meeting, New Orleans, LA  
"Interacting Many-Body Spin Systems that Fail to Quantum Thermalize"
- 10/2016 APS Frontiers in Optics and Laser Science Conference, Rochester, NY  
"2D ion crystals in radiofrequency traps for quantum simulation"
- 09/2016 Purdue University AMO Physics Seminar, West Lafayette, IN  
"Quantum Simulation of Many-Body Spin Systems with Trapped Atomic Ions"
- 06/2016 Air Force Office of Scientific Research Program Review, Arlington, VA.  
"Programmable 2D Arrays of Interacting Quantum Spins Using Trapped Ions"
- 03/2016 Indiana State University Department Colloquium, Terre Haute, IN  
"Quantum Simulation of Many-Body Spin Systems with Trapped Atomic Ions"
- 01/2016 Indiana University-Purdue University Department Colloquium, Indianapolis, IN  
"Quantum Simulation of Many-Body Spin Systems with Trapped Atomic Ions"
- 11/2015 Condensed Matter Seminar, Indiana University, Bloomington, IN  
"Many-Body Localization in a trapped-ion quantum simulator"



- 06/2015 Workshop on Quantum Systems and Technology, Monte Verita, Switzerland  
"Simulating Quantum Many-Body Dynamics with Trapped Atomic Ions"
- 03/2015 Workshop on Quantum Information in Ion Traps, Tel Aviv, Israel  
"Simulating Quantum Magnetism Beyond the Ising Model"
- 11/2014 Indiana University Physics Department Colloquium, Bloomington, IN  
"Simulating Quantum Many-Body Dynamics with Trapped Atomic Ions"
- 11/2014 Atomic Physics Seminar, Lockheed Martin, Littleton, CO  
"Simulating Quantum Many-Body Dynamics with Trapped Atomic Ions"
- 10/2014 Quantum Sciences Seminar, Honeywell ACS, Golden Valley, MN  
"Simulating Many-Body Quantum Dynamics with Trapped Ions"
- 10/2014 Quantum Innovators Workshop, Inst. for Quantum Computing, Waterloo, Canada  
"Simulating quantum many-body states with trapped atomic ions"
- 09/2014 Army Research Laboratory Quantum Science Seminar, Adelphi, MD  
"Studying zero-temperature quantum phenomena with laser-cooled atomic ions"
- 08/2014 International Conference on Atomic Physics (ICAP 2014), Washington, D.C.  
"Simulating Quantum Many-Body Dynamics with Trapped Atomic Ions"
- 04/2014 Georgetown University Condensed Matter Seminar, Washington, D.C.  
"Quantum Simulation of Many-Body Spin Systems: Ground States to Dynamics"
- 03/2014 Georgia Tech Research Institute Quantum Information Seminar, Atlanta, GA.  
"Quantum Simulation of Many-Body Spin Systems with Trapped Atomic Ions"
- 03/2014 Quantum Entanglement Detection and Quantification Conference, Bilbao, Spain.  
"Simulating Excited-State Many-Body Dynamics with Trapped Ions."
- 01/2014 University of Illinois Urbana-Champaign QI/AMO Seminar, Urbana, IL  
"Quantum Simulation of Many-Body Spin Systems with Trapped Atomic Ions"
- 01/2014 Indiana University-Purdue University Department Colloquium, Indianapolis, IN  
"Quantum Simulation of Many-Body Spin Systems with Trapped Atomic Ions"
- 12/2013 iQSim Workshop on Quantum Simulations with Trapped Ions, Brighton, UK.  
"Quantum Simulators: From Ground to Excited States."
- 09/2013 ITAMP Workshop on Quantum Applications with Trapped Ions, Cambridge MA.  
"Quantum Simulations of Spin Models with Trapped Ions."
- 05/2013 DARPA Optical Lattice Emulator Conference, San Francisco CA.  
"Ising spin networks with long range interaction in linear and 2D arrays of ions."
- 04/2013 Joint Quantum Institute Seminar, College Park MD.  
"Quantum Simulation of a Many-Body Spin System Using Many Trapped Ions."

- 03/2013 Adiabatic Quantum Computing Workshop 2013, London, UK.  
"Adiabatic Quantum Simulation of Frustrated Spin Models with Trapped Ions."
- 06/2012 APS DAMOP 2012 Hot Topics Session, Anaheim, CA.  
"Antimatter Advances Include Trapped Antihydrogen in Its Ground State."
- 01/2012 NIST Seminar, Gaithersburg, MD.  
"Trapped Antihydrogen in Its Ground State."
- 01/2012 Joint Quantum Institute Special Seminar, College Park, MD.  
"Trapped Antihydrogen in Its Ground State."

CONTRIBUTED TALKS:

- 05/2016 APS DAMOP 2016, Providence, RI  
"Quantum Simulation with 2D Arrays of Trapped Ions"
- 06/2015 APS DAMOP 2015, Columbus, OH  
"Realization of Quantum Integer Spin Chains with Controllable Interactions"
- 06/2013 APS DAMOP 2013, Quebec City, Canada.  
"Optimizing Adiabaticity in a Trapped-Ion Quantum Simulator."
- 02/2013 Southwest Quantum Information & Technology (SQuInT) 2013, Santa Barbara, CA.  
"Quantum Simulation of Frustrated Spin Models with Trapped Ions."
- 06/2012 DAMOP 2012, Anaheim, CA.  
"Trapped Antihydrogen in Its Ground State."
- 04/2009 Harvard Center for Ultracold Atoms Student Talks, Cambridge, MA.  
"An Improved Apparatus for Antihydrogen Trapping."

POSTERS AND CONFERENCE PROCEEDINGS:

- 07/2023 "QDoor: Exploiting Approximate Synthesis for Backdoor Attacks in Quantum Neural Network Circuits," C. Chu, F. Chen, P. Richerme, and L. Jiang  
Design Automation Conference, San Francisco, CA
- 07/2019 North American Conference on Trapped Ions, College Park MD  
"Quantum Simulation with 2D Lattices of Trapped Ions"
- 04/2017 "Interacting Many-Body Spin Systems That Fail to Quantum Thermalize."  
P. Richerme, P. W. Hess, A. Lee, B. Neyenhuis, J. Smith, J. Zhang, and C. Monroe.  
*Quantum Information and Measurement (QIM) 2017, OSA Technical Digest*, paper QT4.A1 (2017).
- 08/2016 Gordon Research Conference on Quantum Science, Easton MA  
"Quantum Simulation with 2D Arrays of Trapped Ions"

- 10/2014 "Quantum Simulation of Spin Models with Trapped Ions."  
C. Monroe, W.C. Campbell, E.E. Edwards, R. Islam, D. Kafri, S. Korenblit, A. Lee, P. Richerme, C. Senko, and J. Smith. *Proc. Int. School Phys. 'Enrico Fermi'*, Course 189, Varenna, Italy, 2013. Edited by M. Knoop, I. Marzoli, and G. Morigi (2014).
- 09/2014 European Conference on Trapped Ions, Mainz, Germany  
"Simulating quantum many-body dynamics with trapped atomic ions."
- 07/2014 Gordon Research Conference on Quantum Science, Easton MA  
"Quantum Simulators: From Ground to Excited States."
- 02/2014 DARPA Optical Lattice Emulator Conference, Arlington, VA.  
"Quantum Simulators: From Ground to Excited States."
- 12/2013 iQSim Workshop on Quantum Simulations with Trapped Ions, Brighton, UK.  
"Quantum Simulators: From Ground to Excited States."
- 09/2013 ITAMP Workshop on Quantum Applications with Trapped Ions, Cambridge MA.  
"Simulating Quantum Magnetism Using Trapped Ions."
- 06/2013 "Quantum Networks with Atoms and Photons"  
C. Monroe, W. Campbell, C. Cao, T. Choi, S. Clark, S. Debnath, C. Figgatt, D. Hayes, D. Hucul, V. Inlek, R. Islam, S. Korenblit, K. Johnson, A. Manning, J. Mizrahi, B. Neyenhuis, A. Lee, P. Richerme, C. Senko, J. Smith, and K. Wright. *J. Phys.: Conf. Ser.* **467**, 012008 (2013).
- 06/2013 Gordon Research Conference on Atomic Physics, Newport RI. "Simulating Quantum Magnetism Using Trapped Ions."
- 11/2012 DARPA Optical Lattice Emulator Conference, Miami FL. "Frustrated Antiferromagnetism in a Trapped Ion Quantum Simulator with Tunable Long-Range Interactions."
- 08/2008 "Cryogenic Particle Accumulation In ATRAP And The First Antihydrogen Production Within A Magnetic Gradient Trap For Neutral Antimatter"  
C.H. Storry, A. Carew, D. Comeau, E.A. Hessels, M. Weel, M.C. George, D. Grzonka, W.Oelert, T. Seifzick, Z. Zhang, G. Gabrielse, P. Laroche, D. LeSage, B. Levitt, W.S. Kolthammer, R. McConnell, P. Richerme, J. Wrubel, A. Speck, F. Markert, F. Nilius, M. Scheid, and J. Walz. *Proc. of the Workshop on Cold Antimatter Plasmas and Application to Fundamental Physics.* **1037**, 254 (2008).
- 07/2008 International Conference on Atomic Physics (ICAP) 2008, Storrs, CT. "First Antihydrogen Production Within a Penning-Ioffe Trap."
- 04/2008 Cambridge-Connecticut AMO Open House, Cambridge, MA. "A Combined Penning-Ioffe Trap for Antihydrogen."

## TEACHING

2024 Indiana University P332: Theory of Electricity and Magnetism II (Spring)

- 2023 Indiana University P331: Theory of Electricity and Magnetism I (Fall)
- 2022 Indiana University P201: General Physics I (Spring)  
Indiana University P331: Theory of Electricity and Magnetism I (Fall)
- 2021 Indiana University P453: Quantum Mechanics I (Spring)  
Indiana University X498: Undergrad. Readings in Quantum Information (Spring)  
Indiana University P454: Quantum Mechanics II (Fall)
- 2020 Indiana University P453: Quantum Mechanics I (Spring)  
Indiana University P454: Quantum Mechanics II (Fall)
- 2019 Indiana University P222: Physics II (Spring)
- 2018 Indiana University P222: Physics II (Spring)  
Indiana University P221: Physics I (Fall)
- 2017 Indiana University P332: Theory of Electricity and Magnetism II (Spring)  
Indiana University X498: Undergrad. Readings in Quantum Information (Spring)  
Indiana University P221: Physics I (Fall)
- 2016 Indiana University P332: Theory of Electricity and Magnetism II (Spring)  
Indiana University P331: Theory of Electricity and Magnetism I (Fall)  
Indiana University P803: Readings in Experimental Quantum Information (Fall)
- 2015 Indiana University P331: Theory of Electricity and Magnetism I (Fall)
- 2014 Joint Quantum Institute Summer School Speaker  
2014 Guest lecturer for Quantum Mechanics I, University of Maryland
- 2008-9 Teaching fellow, Modern Optics and Quantum Electronics, Harvard University

## ADVISING

- 2018- Ph.D. dissertation committee member to 7 graduate students at Indiana University: Irfan Abu Ashik (Ph.D. 2022), Anurag Dwivedi, Will Holdhusen, J.B. Holmes (Ph.D. 2022), Abhishek Kumar (Ph.D. 2022), Shufan Lu, Debadrita Saha
- 2016- Advisor to 4 M.S. students, 6 Ph.D. students, and 2 postdoctoral associates at Indiana University: Dr. Jiafeng Cui (2020-23), Dr. Antonis Kyprianidis, Josh Apanavicius (M.S. 2022), Thomas Burkle (M.S. 2023; Ph.D. in-process), Marissa D'Onofrio (Ph.D. 2022), Kevin Goodman (M.S. in-process), Ilyoung Jung (Ph.D. in-process), Michelle Lollie (M.S. 2018), AJ Rasmusson (Ph.D. in-process), Frank Schroer (Ph.D. in-process), Yuanheng Xie (Ph.D. 2022)
- 2015- Lab supervisor to 26 undergraduate students and 2 high-school students at Indiana University: Alex Alani, Josh Apanavicius, Alexander Baker, Harvey Campos, Dane Cross, Sam Dunipace, Cassandra Egyhazi, Sahand Emamian, Louis Farenci, Anton Frommelt, Nicolette Goldstein, Ryan Hastings, Andrew Henderson, Ciaran Hill, Eleni Hughes, Advait Iyengar, Justin Kittell, Brooke Liao, Paula Madetzke, Aaron

McCann, Luke Meeker, Sam Norrell, Noah Schlossberger, Grant Schumacher, Rusil Wickramasekera, Evangeline Wolanski, Mofan Zhang

- 2012-15 Directly supervised 6 graduate students at the University of Maryland. All were involved in the experimental effort to perform quantum simulations of many-body physics using trapped ions.
- 2008-11 Directly supervised 4 undergraduate students at Harvard University. Projects included cryogenic apparatus design and assembly, high current circuitry, experimental control software, and finite-element analysis of electromagnetic fields in a Penning trap.

## **SERVICE TO INSTITUTIONS**

### INDIANA UNIVERSITY PHYSICS DEPARTMENT:

- 2024 Chair of Physics hiring Subcommittee for two Faculty-100 searches in Applied Quantum Information Science
- 2023 Member of hiring committee for Faculty-100 initiative in Quantum Information Science
- 2023 Hosted Colloquium Speaker Timothy Kovachy (Northwestern University)
- 2023 Hosted Condensed Matter Seminar Speaker Jacob Covey (Univ. of Illinois)
- 2023 REU Seminar speaker: "Quantum Simulation with Trapped Atomic Ions"
- 2022 Member of the Physics Department Executive Committee
- 2022 Current research in Physics (P408/508) speaker: "Quantum Simulation with Trapped Atomic Ions"
- 2022 Hosted seminar speaker Sabre Kais (Purdue University)
- 2022 REU Seminar speaker: "Quantum Simulation with Trapped Atomic Ions"
- 2021 Member of the Physics Department Executive Committee
- 2021 Hosted Colloquium Speaker Monika Schleier-Smith (Stanford University).
- 2021 Hosted Colloquium Speaker Norman Yao (UC Berkeley).
- 2021 REU Seminar speaker: "Quantum Simulation with Trapped Atomic Ions"
- 2021 Member of hiring committee for new faculty position in Intelligent Systems Engineering in quantum and nonlinear optics
- 2020 Member of the Physics Department Executive Committee
- 2020 Hosted Colloquium Speakers Bryce Gadway (Univ. of Illinois Urbana-Champaign) and Vedika Khemani (Stanford University)
- 2020 Member of hiring committee for new quantum faculty position in Computer Science
- 2019 Member of the Physics Department Executive Committee
- 2019 REU Seminar speaker: "Quantum Simulation with Trapped Atomic Ions"
- 2019 Current research in Physics (P408/508) speaker: "Quantum Simulation with Trapped Atomic Ions"
- 2019 Hosted CMP/LENS/AMO seminar speakers: Jiafeng Cui (Northwestern University) and Matthew Dietrich (Argonne National Lab)

- 2019 Member of Ad-hoc committee to evaluate a new quantum apparatus for advanced undergraduate labs
- 2019 IU Undergraduate Physics Club speaker: "The Coming Age of Quantum Information"
- 2018 Co-chair of faculty search committee for AMO/Quantum Information Experimentalist
- 2018 Hosted CMP/LENS seminar speakers: Chen-Lung Hung (Purdue University), Jeff Ou (IUPUI)
- 2018 Hosted Department Colloquium speaker: Cheng Chin (Univ. of Chicago)
- 2018 REU Seminar speaker: "Quantum Simulation with Trapped Atomic Ions"
- 2018 Current research in Physics (P408/508) speaker: "Quantum Simulation with Trapped Atomic Ions"
- 2017 Undergraduate Thesis Supervised: Noah Schlossberger, "An Experimental Configuration to Probe for Lorentz Symmetry Violation in Electrons Using Trapped Yb+ Ions"
- 2017 Grad Day speaker and tour guide
- 2017 Hosted Department Colloquium speaker: Chris Monroe (Univ. of Maryland)
- 2017 Hosted CMP/LENS seminar speakers: Paul Hess (Univ. of Maryland), Le Luo (IUPUI)
- 2017 Current research in Physics (P408/508) speaker: "Quantum Simulation with Trapped Atomic Ions"
- 2017 REU Seminar speaker: "Quantum Simulation with Trapped Atomic Ions"
- 2017 Guest speaker to IU Bridge Program students: "Perspectives on Funding"
- 2016 Hosted Department Colloquium speaker: David Huse (Princeton Univ.)
- 2016 Hosted CMP/LENS seminar speakers: Smitha Vishveshwara (UIUC), Taylor Hughes (UIUC), Kater Murch (Washington Univ. in St. Louis).
- 2016 IU Undergraduate Physics Club speaker: "Physics of Music"
- 2016 Current research in Physics (P408/508) speaker: "Quantum Simulation with Trapped Atomic Ions"
- 2016 REU Seminar speaker: "Quantum Simulation with Trapped Atomic Ions"
- 2015 IU Undergraduate Physics Club speaker: "Quantum Simulation with Trapped Atomic Ions"

*COMMITTEE SERVICE*

- 2023- Bridge Program Committee
- 2023- Physics Club Co-Supervisor
- 2021-23 Physics Department Long-Range Planning Committee
- 2020-21 Graduate Curriculum and Exams Committee
- 2019-20 Teaching of Physics Committee
- 2019-20 Colloquium Committee
- 2018-19 Graduate Curriculum and Exams Committee
- 2017-18 Student/Staff/Faculty Relations Committee
- 2016-17 Outreach Committee
- 2015-17 Graduate Curriculum and Exams Committee
- 2015- Emergency Control Committee (Committee Chair from 2019-)
- 2015-21 Undergraduate Curriculum Committee

INDIANA UNIVERSITY:

- 2024 Search Committee for Executive Director of Team-Based Research & Development
- 2024 Chair of multi-departmental hiring committee for 4 Faculty-100 searches in Applied Quantum Information Science
- 2023-26 College Committee for Undergraduate Education
- 2023 Wrote 38 letters of recommendation for 12 students
- 2022 IUB 2030 Working Group on High-Impact Transformational Research Areas of Focus
- 2022 Wrote 39 letters of recommendation for 23 students
- 2021-22 General Education for the 21st Century Task Force, Enduring Questions Subcommittee
- 2021 Host and Moderator for IU Federal Relations Webinar with the Air Force Office of Scientific Research and the Air Force Research Laboratory
- 2021 Wrote 107 letters of recommendation for 18 students
- 2020- Quantum Science and Engineering Center Executive Committee
- 2020- Fleischer Research Scholarship Review Committee
- 2020 Wrote 104 letters of recommendation for 14 students
- 2019 Speaker to the College Executive Dean's Advisory Board on the Emerging Areas of Research project "Center for Quantum Science and Engineering"
- 2019 Wrote 22 letters of recommendation for 9 students
- 2018 Wrote 41 letters of recommendation for 14 students
- 2017 Wrote 65 letters of recommendation for 10 students
- 2016 Wrote 92 letters of recommendation for 17 students
- 2016 Event-day coordinator and volunteer at Indiana Science Fest
- 2016 New Faculty Orientation Speaker: "Setting Up Your Lab," hosted by the office of the VPFAA and the OVPR
- 2015- Yearly volunteer at Indiana Science Fest

UNIVERSITY OF MARYLAND:

- 2014 Joint Quantum Institute Tour Coordinator for ICAP 2014
- 2013 Session Judge: Graduate Research Interaction Day

CERN:

- 2011 Invited blogger for "Quantum Diaries," a site dedicated to sharing the work and thoughts of physicists at CERN and around the world
- 2010-12 CERN tour guide for the Antiproton Decelerator

**SERVICE TO PROFESSION**

REVIEWING:

- 2022 Ph.D. Thesis Examiner, University of Sussex, United Kingdom
- 2021 Ph.D. Thesis Examiner, University of Innsbruck, Austria
- 2019 Proposal reviewer for the Northwestern Univ. Center for Fundamental Physics (total: 9 proposals)
- 2018- Proposal reviewer for the Dept. of Energy Quantum Information Science and Fusion Energy Sciences Programs (total: 6 proposals)
- 2017- Proposal reviewer for the Air Force Office of Scientific Research and the Air Force Research Laboratory (total: 3 proposals)
- 2015- Proposal reviewer for National Science Foundation and the Swiss National Science Foundation (total: 13 proposals)

2013- Referee for Science, Nature, Nature Physics, Nature Communications, Physical Review Letters, Physical Review X, Physical Review A, Physical Review D, New Journal of Physics, Physics Today, Quantum Information Processing, Europhysics Letters (total: 72 reviews)

ORGANIZING:

2023- Chair of the Program Committee: APS March Meeting 2024, Division of Atomic, Molecular, and Optical Physics

2022 Program Committee for APS March Meeting 2023, Division of Atomic, Molecular, and Optical Physics

2022 Session Chair: "Advancing Technologies and Techniques for Trapped Ions," APS DAMOP Meeting, Orlando, FL

2022 Session Chair, Ninth Meeting on CPT and Lorentz Symmetry, Bloomington, IN (Virtual)

2021 Session Chair: "Lorentz- and CPT-Breaking Effects in Penning Traps," IUCSS Summer Workshop on Lorentz- and CPT-violating Standard Model Extension, Bloomington, IN

2021 Conference Co-Organizer: "IU-Sorbonne Workshop on Quantum Information Science," Bloomington, IN (Virtual)

2019 Session Chair: "Ion traps in Industry," North American Conference on Trapped Ions, College Park, MD

2017-18 Program Committee for APS March Meeting, Division of Quantum Information

2017 Session Chair: "Ions," OSA Quantum Information and Measurement Meeting, Paris, France

2017 Session Chair: "Advances in Analog Quantum Simulation," APS March Meeting, New Orleans, LA

2016 Session Organizer: "Advances in Quantum Simulation," APS March Meeting 2017, New Orleans, LA

2016 Session Chair: Advances and Recent Experiments with Different Realizations of Quantum Bits, APS DAMOP Conference, Providence, RI

2013 Session Chair: Quantum Information Processing with Ions, APS DAMOP Conference, Quebec City, Canada

2013-5 Abstract sorter for APS DAMOP and March Meeting conferences

2012 Session Chair: Particle Spectroscopy, APS DAMOP Conference, Anaheim CA

ADVISORY:

2020 Member of the DoD "Defense Civilian Auxiliary Corps" to advise senior DoD representatives on compelling problems and solutions from academia and industry

2014 Invited scientific panelist for the Charleston Conference on Library Science, Charleston, SC

2014 Visiting Committee for the APS journal Phys. Rev. X, Stony Brook, NY