

# Kaden Hazzard

## Curriculum Vitae

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Rice University

### Employment and other appointments

- July 2021–... **Rice University**  
Associate Professor of Physics and Astronomy
- 2014–2021 **Rice University**  
Assistant Professor of Physics and Astronomy
- 2010–2014 **JILA, NIST, University of Colorado, Boulder**  
JILA research associate → NRC postdoctoral fellow at JILA → JILA senior research associate (advisor Ana Maria Rey): mainly cold atoms theory.
- 2004–2010 **Laboratory of Atomic and Solid-State Physics, Cornell University**  
Graduate research assistant with Erich Mueller: mainly cold atoms theory.

### Education

- 2010 **Ph.D. physics**, *Cornell University*.  
Thesis title *Quantum phase transitions in cold atoms and low temperature solids*  
Advisor: Erich Mueller
- 2009 **M.S. physics**, *Cornell University*.
- 2004 **B.S. physics, math**, *The Ohio State University*.  
coursework completed with honors in the liberal arts. Also finished all chemistry minor courses.

### Awards and honors

- 2019 NSF CAREER Award
- 2018 Fellow, Institute of Quantum Science and Engineering, Texas A&M
- 2018 & 2021 Finalist for Sophia Meyer Farb Prize for Teaching at Rice University (one of about 5 across entire university)
- 2017 New Journal of Physics Outstanding Referee
- 2017 AI Grant Fellow (Fall 2017) for machine learning applied to quantum dynamics
- 2010 Springer thesis prize: thesis selected to be published as a book
- 2006–2007 GAANN fellowship
- 2004–2006 Special Cornell Graduate fellowship
- 2004 Hertz Fellowship Finalist

- 2004 Phi Beta Kappa, elected to  
2000–2004 Semiconductor Research Corporation Undergraduate Research Assistant Award

## Teaching

- Spring 2022 **Statistical Mechanics**, Physics 526 (graduate course)  
Fall 2021 **Intermediate Mechanics**, Physics 301 (undergraduate course)  
Spring 2021 **Statistical Mechanics**, Physics 526 (graduate course)  
Fall 2020 **Intermediate Mechanics**, Physics 301 (undergraduate course)  
Spring 2020 **Statistical Mechanics**, Physics 526 (graduate course)  
Spring 2019 **Statistical Mechanics**, Physics 526 (graduate course)  
Spring 2018 **Statistical Mechanics**, Physics 526 (graduate course)  
Fall 2017 **Intermediate Mechanics**, Physics 301 (undergraduate course)  
Spring 2017 **Fundamentals of Quantum Optics**, Physics 572 (graduate course)  
Fall 2016 **Intermediate Mechanics**, Physics 301 (undergraduate course)  
Spring 2016 **Engineering quantum matter in AMO systems**, Physics 600 (graduate course)  
Fall 2015 **Intermediate Mechanics**, Physics 301 (undergraduate course).  
Spring 2015 **Fundamentals of Quantum Optics**, Physics 572 (graduate course).

Created and filmed guest lessons on ultracold matter and quantum computing for a “flipped” sophomore Rice electrical engineering course, and filmed a guest lecture on ultracold matter for a Rice graduate course that was broadcast to several other institutions. Before joining Rice, had privately tutored, and substitute lectured, TA’ed, and graded ten courses.

## Professional service and consulting

**Virtual AMO Seminar (VAMOS) DAMOP committee**, July 2021–present

**Workshop session organizer:** “Optimization in Quantum Computing and vice-versa” session at INFORMS workshop (co-organizers: A. Kyriallidis, A. Kalev, L. Duenas-Osorio, G. Pagano), October 2021

**Conference organizer:** Kavli Institute for Theoretical Physics (KITP) conference on “Non-Equilibrium Universality in Many-Body Physics,” (co-organizers: P. Calabrese, L. F. Cugliandolo, M Maghrebi, and J. Schmiedmayer), September 2021

**APS Physics Next Workshop on the Future of Scientific Publication and Research Dissemination participant**, 2021.

**Organizer of 2021 Boulder Summer School on Condensed Matter Physics. Summer school topic: "Ultracold Matter"** A month-long, NSF-sponsored summer school for advanced graduate students and postdocs, bringing in roughly 25 lecturers at Univ. of Colorado-Boulder (co-organizers I. Spielman, A. M. Rey, and L. Radzihovsky), July 2021.

**Editor** *Frontiers of Physics* (2021–present)

**Site Visit Panelist:** National Science Foundation site visit to an NSF-funded quantum information Center, Nov. 2020

**APS Group for Few-body Physics and Multiparticle Dynamics (GFB) nominating committee, 2020–2021**

**APS DAMOP education committee, 2020–2021**

**APS DAMOP program committee, 2019–2022**

*Subcommittee chair:* DAMOP March Meeting 2020 program

*Subcommittee chair:* DAMOP March Meeting 2021 program

**Hacking for Defense scientific contact.** 2020–present. Scientific contact for University of Alabama-Huntsville's *Hacking for Defense* program.

**Workshop steering committee member:** Kavli-Rice workshop on quantum sensing, part of "Sensing the Future: The Future of Sensing" series, Dec. 2019.

**Site Visit Panelist:** National Science Foundation site visit to an NSF-funded atomic, molecular, and optical physics (AMO) Center, Oct. 2019

**National Science Foundation workshop on quantum simulators for an NSF Convergence Accelerator Program, Sep. 2019**

**Workshop organizer:** Harvard ITAMP workshop on "Quantum Phases of Fermions in Optical Lattices: The Low-Temperature Frontiers," Oct. 2018 (co-organizers: H. Sadeghpour, D. Greif, R. Hulet, M. Greiner)

**Editorial board member** PLOS ONE, Academic Editor on Quantum Physics team (2017–2020)

**Consulting:**

- *Scientific consultant:* QWidgetCo, quantum technology startup (2017–19)
- *Council member:* Gerson Lehrman Group (2018–2020)
- *The Implementation Group:* external grant reviewer (2018–present)

**APS March Meeting sorting.** Abstract sorting for 2017 meeting.

**Workshop organizer:** Rice Center for Quantum Materials "Interacting Quantum Systems Out of Equilibrium," May 2016 (co-organizers: D. Natelson, J. Kono, and M. Foster)

**Grant proposal referee and/or panel member:**

- National Science Foundation (NSF)
- Department of Energy (DOE)
- Deutsche Forschungsgemeinschaft (German Research Foundation)
- Austrian Science Fund (FWF)
- W. M. Keck Foundation
- ETH Zurich Research Commission
- European Commission's Future and Emerging Technologies Programme
- Research Grant Council (RGC) of Hong Kong
- Rice University Creative Ventures Fund

**Book proposal referee:** Oxford University Press, Cambridge University Press, Springer, Taylor and Francis

**Journal referee:** Nature, Nature Physics, Nature Materials, Nature Communications, Science Advances, Accounts in Chemical Research, Physical Review Letters, Physical Review A, Physical Review B, New Journal of Physics, Scientific Reports, SciPost, Advanced Quantum Technologies, Frontiers of Physics, Quantum Information Processing, Annals of Physics, Journal of Physics B, Physics Letters A, Physica A

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## Press on research

PRX Quantum **1**, 010303 (2020)

- "Quantum leap for speed limit bounds," Rice News
- "Quantum leap for speed limit bounds," phys.org
- EurekAlert!, ScienceDaily, bioengineer.com, ...

NSF CAREER award (2019)

- Rice News
- EurekAlert!
- Coshocton County Beacon

Science **345**, 306 (2014)

- "Quantum systems under control", Science perspective
- "Little shop of atoms", JILA research highlight (web and magazine)

Phys. Rev. Lett. **112**, 070404 (2014) ["Editor's Suggestion"]

- "Dealing with Loss", JILA research highlight (web and magazine)

Nature **501**, 521 (2013)

- "Molecules line up in laser grid", Physics World
- "Rotating molecules as quantum magnets", Nature News and Views
- "Spins swapped at a distance", Overclocker's club
- "The great spin swap", JILA research highlight (web and magazine)
- "Beyond quantum simulation: JILA physicists create 'crystal' of spin-swapping ultracold gas molecules", NIST Newsletter
- Also featured on phys.org, ScienceDaily, Nanotechnology News, pro-physik.de, ...

Phys. Rev. Lett. **110**, 075301 (2013)

- "Model Behavior", JILA research highlight (web and magazine)

Phys. Rev. A **85**, 041604 (2012)

- "New Flavors of Quantum Magnetism", JILA research highlight (web and magazine)

Phys. Rev. Lett. **92**, 045501 (2004)

- NCSA News article "Salted Away Silicon"

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## Publications

### Preprints (submitted)

74. *Realizing Su-Schrieffer-Heeger topological edge states in Rydberg-atom synthetic dimensions*  
S. K. Kanungo, J. D. Whalen, Y. Lu, M. Yuan, S. Dasgupta, F. B. Dunning, **K. R. A. Hazzard**, and T. C. Killian  
arxiv:2101.02871
73. *Observation of antiferromagnetic correlations in an ultracold  $SU(N)$  Hubbard model*  
S. Tai, E. Ibarra-García-Padilla, N. Nishizawa, Y. Takasu, Y. Kuno, H.-T. Wei, R. T. Scalettar, **K. R. A. Hazzard**, Y. Takahashi  
arxiv:2010.07730
72. *A quantum algorithm to count weighted ground states of classical spin Hamiltonians*  
B. Sundar, R. Paredes, D. T. Damanik, L. Dueñas-Osorio, and **K. R. A. Hazzard**  
arxiv:1908.01745
71. *Quantum dynamics from a numerical linked cluster expansion*  
Ian G. White, Bhuvanesh Sundar, and **Kaden R. A. Hazzard**  
arxiv:1710.07696

### Journal articles

70. *Complex collisions of ultracold molecules: a toy model*  
J. K. Yao, C. A. Johnson, N. P. Mehta, and **Kaden R. A. Hazzard**  
Phys. Rev. A **104**, 053311 (2021)
69. *Universal thermodynamics of an  $SU(N)$  Fermi-Hubbard Model*  
Eduardo Ibarria-García-Padilla, Sohail Dasgupta, Hao-Tian Wei, Shintaro Taie, Yoshiro Takahashi, Richard T. Scalettar, and **K. R. A. Hazzard**  
Phys. Rev. A **104**, 043316 (2021)  
*Editor's Suggestion*
68. *Viewpoint: Photons Get Slippery*  
**Kaden R. A. Hazzard**  
Physics **14**, 139 (2021)

67. *Nonlinear Dynamics in a Synthetic Momentum-State Lattice*  
F. A. An, B. Sundar, J. Hou, X.-W. Luo, E. J. Meier, C. Zhang, **K. R. A. Hazzard**,  
and B. Gadway  
Phys. Rev. Lett. **127**, 130401 (2021) [*Editor's Suggestion*]
66. *Bounding the finite-size error of quantum many-body dynamics simulations*  
Z. Wang, M. Foss-Feig, and **K. R. A. Hazzard**  
Phys. Rev. Research **3**, L032047 (2021)
65. *Quantum Simulators: Architectures and Opportunities*  
E. Altman et al. (**K. R. A. Hazzard** and 36 others)  
PRX Quantum **2**, 017003 (2021)
64. *Thermodynamics and magnetism in the 2D-3D crossover of the Hubbard model*  
Eduardo Ibarra-García-Padilla, Rick Mukherjee, Randall G. Hulet, **Kaden R. A. Hazzard**,  
Thereza Paiva, and Richard T. Scalettar  
Phys. Rev. A **102**, 033340 (2020)
63. *Spin-imbalanced ultracold Fermi gases in a two-dimensional array of tubes*  
Bhuvanesh Sundar, Jacob A. Fry, Melissa C. Revelle, Randall G. Hulet, and **Kaden R. A. Hazzard**  
Phys. Rev. A **102**, 033311 (2020)
62. *Tightening the Lieb-Robinson bound in locally interacting systems*  
Z. Wang and **K. R. A. Hazzard**  
PRX Quantum **1**, 010303 (2020)
61. *Numerical linked cluster expansions for inhomogeneous systems*  
Johann Gan and **Kaden R. A. Hazzard**  
Phys. Rev. A **102**, 013318 (2020)
60. *Collective modes of ultracold fermionic alkaline-earth gases with  $SU(N)$  symmetry*  
Sayan Choudhury, Kazi R. Islam, Yanhua Hou, Jim A. Aman, Thomas C. Killian, and  
**Kaden R. A. Hazzard**  
Phys. Rev. A **101**, 053612 (2020)
59. *Correlations generated from high-temperature states: Nonequilibrium dynamics in the Fermi-Hubbard model*  
Ian G. White, Randall G. Hulet, and **Kaden R. A. Hazzard**  
Phys. Rev. A **100**, 033612 (2019)
58. *High-intensity two-frequency photoassociation spectroscopy of a weakly bound molecular state: theory and experiment*  
W. Y. Kon, J. A. Aman, J. C. Hill, T. C. Killian, and **Kaden R. A. Hazzard**  
Phys. Rev. A **100**, 013408 (2019)
57. *Cold atoms in optical lattices*  
**Kaden R. A. Hazzard** and Bhuvanesh Sundar  
Invited review; Chapter in "2D Quantum Mechanics: Proceedings of the 2018 NIST Workshop" on two-dimensional meta-materials, ed. Wiley P. Kirk, John N. Randall, and James H. G. Owen (2019).

56. *Analysis of continuous and discrete Wigner approximations for spin dynamics*  
 Bhuvanesh Sundar, Kenneth C. Wang, and **Kaden R. A. Hazzard**  
 Phys. Rev. A **99**, 043627 (2019)
55. *A traffic jam of light*  
**Kaden R. A. Hazzard**  
 Nature **566**, 45 (2019)  
 invited News & Views article
54. *Strings of ultracold molecules in a synthetic dimension*  
 Bhuvanesh Sundar, Matthew Thibodeau, Zhiyuan Wang, Bryce Gadway, and **Kaden R. A. Hazzard**  
 Phys. Rev. A **99**, 013624 (2019).
53. *A Model for Scattering with Proliferating Resonances: Many Coupled Square Wells*  
 Nirav P. Mehta, **Kaden R. A. Hazzard**, and Christopher Ticknor  
 Phys. Rev. A **98**, 062703 (2018).
52. *Photoassociative Spectroscopy of a Halo Molecule in  $^{86}\text{Sr}$*   
 J. A. Aman, J. C. Hill, R. Ding, **Kaden R. A. Hazzard**, T. C. Killian, and W. Y. Kon,  
 Phys. Rev. A **98**, 053441 (2018).  
 selected as "Editor's suggestion"
51. *Cooling Fermions in an Optical Lattice by Adiabatic Demagnetization*  
 Anthony E. Mirasola, Michael L. Wall, and **Kaden R. A. Hazzard**  
 Phys. Rev. A **98**, 033607 (2018).
50. *Bosonic molecules in a lattice: Unusual fluid phase from multichannel interactions*  
 Kevin D. Ewart, Michael L. Wall, and **Kaden R. A. Hazzard**  
 Phys. Rev. A **98**, 013611 (2018)
49. *Viewpoint: Watching a quantum magnet grow in ultracold atoms*  
**Kaden R. A. Hazzard**  
 Physics **11**, 63 (2018)
48. *Complex-network description of thermal quantum states in the Ising spin chain*  
 Bhuvanesh Sundar, Marc Andrew Valdez, Lincoln D. Carr, and **Kaden R. A. Hazzard**  
 Phys. Rev. A **97**, 052320 (2018)
47. *Geometric representation of spin correlations and applications to ultracold systems*  
 Rick Mukherjee, Anthony E. Mirasola, Jacob Hollingsworth, Ian G. White, and **Kaden R. A. Hazzard**  
 Phys. Rev. A **97**, 043606 (2018)
46. *Analytic ground state wave functions of mean-field  $p_x + ip_y$  superconductors with vortices and boundaries*  
 Zhiyuan Wang and **Kaden R. A. Hazzard**  
 Phys. Rev. B **97**, 104501 (2018)
45. *Synthetic dimensions in ultracold polar molecules*  
 Bhuvanesh Sundar, Bryce Gadway, and **Kaden R. A. Hazzard**  
 Scientific Reports **8**, 3422 (2018)

44. *Correlations and enlarged superconducting phase of  $t$ - $J_{\perp}$  chains of ultracold molecules on optical lattices*  
Salvatore R. Manmana, Marcel Möller, Riccardo Gezzi, and **Kaden R. A. Hazzard**  
Phys. Rev. A **96**, 043618 (2017)
43. *Number-conserving interacting fermion models with exact topological superconducting ground states*  
Zhiyuan Wang, Youjiang Xu, Han Pu, and **Kaden R. A. Hazzard**  
Phys. Rev. B **96**, 115110 (2017)
42. *Lattice model parameters for ultracold nonreactive molecules: chaotic scattering and its limitations*  
Michael L. Wall, Rick Mukherjee, Shah Saad Alam, Nirav P. Mehta, and **Kaden R. A. Hazzard**  
Phys. Rev. A **95**, 043636 (2017)
41. *Microscopic derivation of multi-channel Hubbard models for ultracold nonreactive molecules in an optical lattice*  
Michael L. Wall, Nirav P. Mehta, Rick Mukherjee, Shah Saad Alam, and **Kaden R. A. Hazzard**  
Phys. Rev. A **95**, 043635 (2017)
40. *A solid more fluid than a fluid*  
**Kaden R. A. Hazzard**  
Nature **543**, 47 (2017)  
invited News & Views article
39. *Accessing Rydberg-dressed interactions using many-body Ramsey dynamics*  
Rick Mukherjee, Thomas C. Killian, and **Kaden R. A. Hazzard**  
Phys. Rev. A **94**, 053422 (2016)
38. *Synthetic-gauge-field stabilization of the chiral-spin-liquid phase*  
Gang Chen, **Kaden R. A. Hazzard**, Ana Maria Rey, and Michael Hermele  
Phys. Rev. A **93**, 061601(R) (2016)
37. *Ultracold Nonreactive Molecules in an optical lattice: Connecting Chemistry to Many-Body Physics*  
Andris Doçaj, Michael L. Wall, Rick Mukherjee, and **Kaden R. A. Hazzard**  
Phys. Rev. Lett. **116** 135301 (2016)
36. *Rydberg-blockade effects in Autler-Townes spectra of ultracold strontium*  
B. J. DeSalvo, J. A. Aman, C. Gaul, T. Pohl, S. Yoshida, J. Burgdörfer, **K. R. A. Hazzard**, F. B. Dunning, and T. C. Killian  
Phys. Rev. A **93**, 022709 (2016)
35. *Effective many-body parameters for atoms in non-separable Gaussian optical potential*  
Michael L. Wall, **Kaden R. A. Hazzard**, and Ana Maria Rey  
Phys. Rev. A **92**, 013610 (2015).  
selected as "Editor's suggestion"

34. *Quantum magnetism with ultracold molecules*  
Michael L. Wall, **Kaden R. A. Hazzard**, and Ana Maria Rey  
Chapter in "From atomic to mesoscale: The Role of Quantum Coherence in Systems of Various Complexities" ed. S. Malinovskaya and I. Novikova World Scientific (2015)  
[Review article]
33. *Quantum correlations and entanglement in far-from-equilibrium spin systems*  
**Kaden R. A. Hazzard**, Mauritz van den Worm, Michael Foss-Feig, Salvatore R. Manmana, Emanuele G. Dalla Torre, Tilman Pfau, Michael Kastner, and Ana Maria Rey  
Phys. Rev. A **90**, 063622 (2014)
32. *Many-body dynamics of dipolar molecules in an optical lattice*  
**Kaden R. A. Hazzard**, Bryce Gadway, Michael Foss-Feig, Bo Yan, Steven A. Moses, Jacob P. Covey, Norman Y. Yao, Mikhail D. Lukin, Jun Ye, Deborah S. Jin, and Ana Maria Rey  
Phys. Rev. Lett. **113**, 195302 (2014)
31. *Two-particle quantum interference in tunnel-coupled optical tweezers*  
Adam M. Kaufman, Brian J. Lester, Collin M. Reynolds, Michael L. Wall, Michael Foss-Feig, **Kaden R. A. Hazzard**, Ana Maria Rey, and Cindy A. Regal  
Science **345**, 306 (2014)
30. *Suppressing the loss of ultracold molecules via the continuous quantum Zeno effect*  
Bihui Zhu, Bryce Gadway, Michael Foss-Feig, Johannes Schachenmayer, Michael Wall, **Kaden R. A. Hazzard**, Bo Yan, Steven A. Moses, Jacob P. Covey, Deborah S. Jin, Jun Ye, Murray Holland, and Ana Maria Rey  
Phys. Rev. Lett. **112**, 070404 (2014) (selected as "Editor's Choice")
29. *Quenching to unitarity: Quantum dynamics in a 3D Bose gas*  
Andrew G. Sykes, John P. Corson, Jose P. D'Incao, Andrew P. Koller, Chris H. Greene, Ana Maria Rey, **Kaden R. A. Hazzard**, and John L. Bohn  
Phys. Rev. A **89**, 021601(R) (2014)
28. *Dynamical quantum correlations of Ising models on an arbitrary lattice and their resilience to decoherence*  
Michael Foss-Feig, **Kaden R. A. Hazzard**, John J. Bollinger, Ana Maria Rey, and Charles W. Clark  
New J. Phys. **15**, 113008 (2013) (chosen as "IOP Select" article)
27. *Observation of dipolar spin-exchange interactions with lattice-confined polar molecules*  
Bo Yan, Steven A. Moses, Bryce Gadway, Jacob P. Covey, **Kaden R. A. Hazzard**, Ana Maria Rey, Deborah S. Jin, and Jun Ye  
Nature **501**, 521 (2013)
26. *Kitaev honeycomb and other exotic spin models with polar molecules*  
Alexey V. Gorshkov, **Kaden R. A. Hazzard**, and Ana Maria Rey  
Molecular Physics **111**, 1908 (2013), Invited article for Bretislav Friedrich special issue.

25. *Nonequilibrium dynamics of arbitrary-range Ising models with decoherence: An exact analytic solution*  
Michael Foss-Feig, **Kaden R. A. Hazzard**, John J. Bollinger, and Ana Maria Rey  
Phys. Rev. A **87**, 042101 (2013)
24. *Topological phases in ultracold polar-molecule quantum magnets*  
Salvatore R. Manmana, E. M. Stoudenmire, **Kaden R. A. Hazzard**, Ana Maria Rey, and Alexey V. Gorshkov  
Phys. Rev. B **87**, 081106(R) (2013)
23. *Far-from-Equilibrium Quantum Magnetism with Ultracold Polar Molecules*  
**Kaden R. A. Hazzard**, Salvatore R. Manmana, Michael Foss-Feig, and Ana Maria Rey  
Phys. Rev. Lett. **110**, 075301 (2013)
22. *Universality class of quantum criticality in the two-dimensional Hubbard model at intermediate temperatures ( $t^2/U \ll T \ll t$ )*  
**Kaden R. A. Hazzard**, Ana Maria Rey, and Richard T. Scalettar  
Phys. Rev. B **87**, 035110 (2013)
21. *Adiabatic loading of one-dimensional  $SU(N)$  alkaline-earth-atom fermions in optical lattices*  
Lars Bonnes, **Kaden R. A. Hazzard**, Salvatore R. Manmana, Ana Maria Rey, and Stefan Wessel  
Phys. Rev. Lett. **109**, 205305 (2012)
20. *High-temperature properties of fermionic alkaline-earth-metal atoms in optical lattices*  
**Kaden R. A. Hazzard**, Victor Gurarie, Michael Hermele, and Ana Maria Rey  
Phys. Rev. A **85**, 041604 (2012)
19.  *$SU(N)$  magnetism in chains of ultracold alkaline earth atoms: Mott transitions and quantum correlations*  
Salvatore R. Manmana, **Kaden R. A. Hazzard**, Gang Chen, Adrian E. Feiguin, and Ana Maria Rey  
Phys. Rev. A **84**, 043601 (2011)
18. *Spectroscopy of dipolar fermions in layered two-dimensional and three-dimensional lattices*  
**Kaden R. A. Hazzard**, Alexey V. Gorshkov, and Ana Maria Rey  
Phys. Rev. A **84**, 033608 (2011)
17. *Techniques to measure quantum criticality in cold atoms*  
**Kaden R. A. Hazzard** and Erich J. Mueller  
Phys. Rev. A **84**, 013604 (2011)
16. *Local versus global equilibration near the bosonic Mott-superfluid transition*  
Stefan S. Natu, **Kaden R. A. Hazzard** and Erich J. Mueller  
Phys. Rev. Lett. **106**, 125301 (2011)

15. *Atomic H in molecular H<sub>2</sub> crystals: constraints on candidate theories of experimental anomalies*  
**Kaden R. A. Hazzard** and Erich J. Mueller  
 Phys. Rev. B **82** 014303 (2010) (selected as "Editor's Choice")
  14. *Radio-frequency spectra of bosons in optical lattices: bimodality due to many body correlations*  
**Kaden R. A. Hazzard** and Erich J. Mueller  
 Phys. Rev. A **81**, 033404 (2010)
  13. *On-site correlations in optical lattices: band mixing to coupled quantum Hall puddles*  
**Kaden R. A. Hazzard** and Erich J. Mueller  
 Phys. Rev. A **81**, 031602(R) (2010)
  12. *Stirring trapped atoms into Fractional Quantum Hall puddles*  
 Stefan K. Baur, **Kaden R. A. Hazzard** and Erich J. Mueller  
 (KRAH and SKB co-first authors)  
 Phys. Rev. A **78** 061608(R) (2008)
  11. *Influence of film-mediated interactions on the microwave and radio spectrum of spin-polarized hydrogen on helium films*  
**Kaden R. A. Hazzard** and Erich J. Mueller  
 Phys. Rev. Lett. **101**, 165301 (2008)
  10. *Hyperfine spectra of trapped bosons in optical lattices*  
**Kaden R. A. Hazzard** and Erich J. Mueller  
 Phys. Rev. A **76**, 063612 (2007)
  9. *Fast Diffusion Mechanism of Silicon Tri-interstitial Defects*  
 Yaojun A. Du, Stephen A. Barr, **Kaden R. A. Hazzard**, Thomas J. Lenosky, Richard G. Hennig and John W. Wilkins  
 Phys. Rev. B **72**, 241306(R) (2005)
  8. *A Novel Dielectric Anomaly in Cuprates and Nickelates: Signature of an Electronic Glassy State*  
 Tuson Park, Z. Nussinov, **Kaden R. A. Hazzard**, V.A. Sidorov, A.V. Balatsky, J.L. Sarrao, S.-W. Cheong, M.F. Hundley, J.-S. Lee, Q. Jia, and J.D. Thompson  
 Phys. Rev. Lett. **94**, 017002 (2005)
  7. *Complexity of Small Silicon Self-interstitial Clusters*  
 D. A. Richie, Jeongnim Kim, Stephen A. Barr, **Kaden R. A. Hazzard**, Richard Hennig, and John W. Wilkins  
 Phys. Rev. Lett. **92**, 045501 (2004)
- [Conference proceedings and other refereed papers](#)
6. *Detection and Visualization of Anomalous Structures in Molecular Dynamics Data*  
 Sameep Mehta, Raghu Machiraju, Sridhar Parthasarathy, **Kaden R. A. Hazzard**, and John Wilkins  
 IEEE Visualization, Proceedings of the conference on Visualization '04, 465-472 (2004)

5. *Mining Temporally-Varying Phenomena in Scientific Datasets*  
R. Machiraju, S. Parthasarathy, J. Wilkins, D. Thompson, B. Gatlin, D. Richie, T. Choy, M. Jiang, S. Mehta, M. Coatney, S. Barr, and **Kaden R. A. Hazzard**  
In *Advances in Knowledge Discovery*, 2003, eds. H. Kargupta *et al.*
4. *Molecular dynamics as a bridge: fundamentals, methods, and current research*  
**Kaden R. A. Hazzard**  
Reviews in Undergraduate Research, **1**, issue 2 (2003)
3. *Feature Mining Algorithms for Scientific Data*  
M. Jiang, T.-S. Choy, S. Mehta, M. Coatney, S. Barr, **Kaden R. A. Hazzard**, D. Richie, S. Parthasarathy, R. Machiraju, David Thompson, J. Wilkins, and Boyd Gaytlin  
In *Proceedings of SIAM Data Mining Conference*, edited by D. Barbara and C. Kamath, 13-24 (2003)
2. *Large-scale molecular dynamics simulations of interstitial defect diffusion in silicon*  
David A. Richie, Jeongnim Kim, Richard Hennig, **Kaden R. A. Hazzard**, Steven Barr, and John W. Wilkins  
Materials Research Symposium Proceedings, **731**, p. W9. 10-5 (2002)

#### Book

1. *Quantum phase transitions in cold atoms and low temperature solids*  
**Kaden R. A. Hazzard**  
Selected for publication in "Springer Theses" book series, a modified version of my thesis (2011)

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#### Invited talks

91. Quantum technologies and density-functional theory workshop, International Institute of Physics (IIP), Natal, Brazil  
*Title TBD*  
August 2022
90. APS March Meeting 2022 "Non-Equilibrium Physics with Cold Atoms and Molecules, Rydberg Gases, and Trapped Ions" session, Chicago, Illinois.  
*TBD*  
March 2022
89. University of British Columbia-Rice Workshop on Topological Quantum Matter (virtual)  
*Topological synthetic dimensions with programmable ultracold matter*  
December 2021
88. UT Austin Quantum Collective-IBM Quantum Hackathon (virtual)  
*Variational quantum algorithms: from traditional to novel hardware*  
October 2021
87. Center for Quantum Research and Technology Seminar, University of Oklahoma, Norman, Oklahoma (virtual)  
*Synthetic dimensions in ultracold matter*  
August 2021

86. Condensed Matter in the City, London, UK (virtual)  
*Synthetic dimensions in ultracold matter*  
July 2021
85. Boulder Summer School on Ultracold Matter seminar, Boulder, Colorado (virtual)  
*Synthetic dimensions: ultracold molecules, Rydberg atoms, and momentum-space lattices*  
July 2021
84. International physics and astronomy webinar, Pabna University of Science and Technology, Pabna Bangladesh (virtual)  
*Ultracold quantum matter: science to technology*  
June 2021
83. DAMOP 2021 "Cold Gases: Frontiers of SU(N) Physics" session (virtual)  
*Correlations and Universality in Ultracold Alkaline Earth Atoms*  
June 2021
82. Rice Science Cafe & Salon, Houston, TX  
*Science for the Quantum Revolution*  
April 2021
81. Durham University Quantum Light and Matter Group (virtual) Seminar, Durham, United Kingdom  
*Synthetic dimensions: ultracold molecules, Rydberg atoms, and momentum-space lattices*  
October 2020
80. Rice University Physics and Astronomy Colloquium, Houston, TX  
*Ultracold Matter: How cold can it get? How fast can it move?*  
September 2020
79. Virtual seminar on quantum fluids in isolation, Boston College, Boston, Massachusetts  
*Ultracold SU(N) quantum magnetism and structure of correlations in many-body systems*  
June 2020
78. University of Goettingen Institute of Theoretical Physics virtual seminar, Goettingen, Germany  
*Ultracold SU(N) quantum magnetism and structure of correlations in many-body systems*  
June 2020
77. Texas Quantum Institute planning workshop on Quantum Algorithms, Austin, Texas  
*Connecting Quantum Algorithms to Analog Quantum Simulation*  
March 2020
76. Minerva-Gentner Symposium on "Quantum Simulations With Atoms, Molecules and Photons", Tze'elim, Israel  
*Harnessing internal states for quantum simulation*  
February 2020

75. Texas Quantum Institute workshop on Quantum Advantage with Quantum Simulation, Houston, Texas  
*Tutorial on Quantum simulation*  
February 2020
74. Michigan State University CM seminar, East Lansing, Michigan  
*The power within: Quantum magnetism in alkaline earth atoms & synthetic dimensions in molecules*  
February 2020
73. Imperial College London AMO seminar, London, United Kingdom  
*Synthetic dimensions in ultracold molecules (and elsewhere)*  
November 2019
72. "Exploring new regimes of dipolar physics with ultracold molecules," Durham University workshop, Durham, United Kingdom  
*Synthetic dimensions in ultracold molecules (and elsewhere)*  
November 2019
71. Keynote talk at Gulf Coast Undergraduate Research Symposium (GCURS), Houston, Texas  
*Quantum Simulation and Computation*  
November 2019
70. Texas Quantum Institute Kickoff Workshop, College Station, Texas  
*Quantum algorithms and computation in the TQI*  
October 2019
69. Georgia Tech condensed matter & AMO seminar, Atlanta, Georgia  
*Ultracold molecules: from topology to quantum strings*  
August 2019
68. "Emergent phenomena in ultracold atoms: merging topology, interaction, and dynamics" workshop, Kavli Institute for Theoretical Sciences (KITS), Beijing, China.  
*Synthetic dimensions and sticky collisions in ultracold molecules*  
June 2019
67. "Few-body Physics in Cold Atomic Gases conference", Zhuhai, China.  
*Sticky collisions and synthetic dimensions in ultracold molecules*  
June 2019
66. "New frontiers in cold molecules" workshop, Harvard ITAMP, Cambridge, Massachusetts.  
*Synthetic dimensions and sticky collisions in ultracold molecules*  
May 2019
65. University of Houston Physics Colloquium, Houston, Texas  
*Ultracold molecules as a new form of matter: from topology to quantum strings*  
Feb 2019

64. Advances on Quantum Simulation with Ultracold Atoms, International Institute of Physics (IIP), Natal, Brazil.  
*Synthetic dimensions in ultracold molecules: strings and topology*  
October-November 2018
63. Zyvexlabs Workshop on Designed 2D Quantum Metamaterials, Gaithersburg, Maryland.  
*Ultracold matter for quantum simulations: achievements, challenges, and opportunities*  
April 2018
62. American Chemical Society Spring Meeting, "Cold Molecules for Chemistry" symposium, New Orleans, Louisiana.  
*Synthetic dimensions in ultracold molecules: from strings to chemical synthesis*  
March 2018
61. APS March Meeting 2018, "Synthetic Physics: Synthetic Dimensions, Gauge Fields, and Spin-Orbit Coupling" session, Los Angeles, California  
*Synthetic dimensions in ultracold molecules: strings, membranes, topology*  
March 2018
60. Physics of Quantum Electronics workshop, Snowbird, Utah  
*Synthetic dimensions in ultracold molecules*  
January 2018
59. Brazilian Physical Society Meeting, XL ENFMC, Buzios, Brazil  
*Synthetic dimensions and chaotic collisions in ultracold molecules*  
August 2017.
58. Aspen Center for Physics workshop: "Correlations and Entanglement In and Out of Equilibrium", Aspen, Colorado  
*Synthetic dimensions and chaotic collisions in ultracold molecules*  
June 2017.
57. Smalley-Curl Institute Lunch Seminar, Rice University, Houston, Texas.  
*Ultracold matter as analogs of quantum materials... and beyond*  
April 2017
56. Geometry-Analysis seminar, Rice University Department of Mathematics, Houston, Texas  
*Ultracold matter: a window into many-particle quantum physics*  
April 2017
55. Zhejiang University Physics Seminar, Hangzhou, China  
*Ultracold nonreactive molecules: from chaotic collisions to exotic physics*  
October 2016
54. Fudan University Physics Seminar, Shanghai, China  
*Ultracold nonreactive molecules: from chaotic collisions to exotic physics*  
October 2016
53. Joint ICQM-RCQM Workshop on Quantum Matters, Beijing, China.  
*Ultracold nonreactive molecules: from chaotic collisions to exotic physics*  
October 2016

52. Aspen Center for Physics workshop: "Light-matter Interaction and Quantum Control In Many-body Systems", Aspen, Colorado  
*Ultracold nonreactive molecules in an optical lattice: nonstandard Hubbard models from chaotic collisions*  
June 2016
51. Rice Center for Quantum Materials workshop: Interacting Quantum Systems Driven Out of Equilibrium, Houston, Texas.  
*Entanglement in "hot" (100 nK) nonequilibrium matter*  
May 2016
50. Trinity University Physics Seminar, San Antonio, Texas.  
*Novel ultracold platforms for quantum science*  
November 2015.
49. Aspen Center for Physics workshop: "Ultra-cold Quantum Matter with Atoms and Molecules," Aspen, Colorado.  
*Nonreactive ultracold molecules in a lattice: harnessing complex collisions for many-body physics*  
July 2015
48. DAMOP 2015, "Non-equilibrium dynamics in strongly interacting atomic systems" session, Columbus, Ohio  
*Spin-motion coupled dynamics in ultracold atoms and molecules*  
June 2015
47. Ohio State University Condensed Matter seminar, Columbus, Ohio.  
*Quantum magnetism with ultracold molecules far-from-equilibrium*  
April 2015
46. Ohio University Condensed Matter and Surface Science colloquium, Athens, Ohio.  
*What I create, I understand: engineering ultracold matter to decipher real materials*  
April 2015
45. Louisiana State University quantum science and technology seminar, Baton Rouge, Louisiana.  
*No democracy for entanglement: not all entanglements are created equal*  
March 2015
44. Louisiana State University physics colloquium, Baton Rouge, Louisiana.  
*The miracle of molecules: exploring quantum magnetism in ultracold matter*  
March 2015
43. National Institute for Theoretical Physics in Stellenbosch workshop on "Quantum Many-Body Systems Far From Equilibrium," Stellenbosch, South Africa.  
*Correlations and entanglement in open quantum systems*  
March 2015
42. Joint ICQM Peking - RCQM meeting, Houston, Texas  
*Atomic, Molecular, and Optical Physics at Rice University*  
March 2015

41. U.S.-France Workshop on Nano, Extreme Measurements, and Theory (NEXT), an RCQM International Initiative, Houston, Texas  
*Atomic, Molecular, and Optical Physics at Rice University*  
February 2015
40. Rice Center for Quantum Materials inaugural symposium, Houston, Texas  
*Ultracold molecules: quantum magnetism far-from-equilibrium*  
December 2014
39. Heidelberg Center for Quantum Dynamics colloquium, Heidelberg, Germany.  
*The miracle of molecules: exploring quantum magnetism in ultracold matter*  
November 2014.
38. Stuttgart University physics seminar, Stuttgart, Germany.  
*The miracle of molecules: far-from-equilibrium quantum magnetism in ultracold matter*  
November 2014.
37. Technical University of Munich condensed matter and many-body physics seminar, Munich, Germany.  
*The miracle of molecules: quantum magnetism in ultracold matter*  
November 2014.
36. Sam Houston State University physics colloquium, Huntsville, Texas.  
*The miracle of molecules: exploring quantum magnetism in ultracold matter*  
October 2014
35. University of Illinois Urbana-Champaign AMO/quantum information seminar, Champaign-Urbana, Illinois.  
*Quantum magnetism in ultracold molecules*  
October 2014
34. University of Texas at Austin complex quantum systems seminar, Austin, Texas.  
*The miracle of molecules: exploring quantum magnetism in ultracold matter*  
October 2014
33. ECT\* workshop on "Hydrodynamics for Strongly Coupled Fluids," Trento, Italy  
*Quench of a Bose gas to unitarity: dynamics and novel universal singularities*  
May 2014
32. University of Goettingen condensed matter theory seminar, Goettingen, Germany  
*Observing quantum magnetism with ultracold polar molecules*  
May 2014
31. DARPA optical lattice emulator program workshop, Arlington, Virginia  
*Many-body quantum magnetism of dipolar molecules in an optical lattice*  
February 2014
30. University of Colorado Condensed Matter Theory seminar, Boulder, Colorado  
*Quantum magnetism with ultracold molecules*  
February 2014

29. Rice University physics colloquium, Houston, Texas.  
*Quantum simulation with strongly-correlated ultracold polar molecules*  
January 2014
28. University of Chicago James Franck Institute seminar, Chicago, Illinois  
*Quantum magnetism in ultracold molecules: comparing theory and experiment*  
November 2013
27. University of Maryland Condensed Matter Theory Center (CMTC) seminar, College Park, Maryland  
*Quantum magnetism in ongoing ultracold molecule and ion experiments*  
March 2013
26. Georgetown University physics seminar, Washington D. C.  
*Quantum magnetism in ongoing ultracold molecule and ion experiments*  
March 2013
25. FINES-2013 (Finite-temperature Non-Equilibrium Superfluid Systems), Queenstown, New Zealand  
*Far-from equilibrium dynamics of frustrated spin models: polar molecules, ions, and beyond*  
February 2013
24. University of Queensland Quantum Science Seminar, Brisbane, Australia  
*Novel systems in and out of equilibrium bring ultracold quantum magnetism closer to reality*  
February 2013
23. Kavli Institute for Theoretical Physics (KITP), UCSB, Santa Barbara, California  
*Non-equilibrium many-body physics in current molecule experiments*  
February 2013
22. DARPA optical lattice emulator program workshop, Miami, Florida  
*Non-equilibrium Ising quenches with decoherence: an exact solution*  
November 2012
21. Harvard ITAMP AMO seminar, Boston, Massachusetts  
*Towards exotic physics using novel ultracold matter: polar molecules and alkaline earth atoms*  
March 2012
20. DARPA optical lattice emulator program workshop, Ft. Lauderdale, Florida  
*Quantum criticality and non-equilibrium dynamics in ultracold lattice systems*  
December 2011
19. Rice University AMO seminar, Houston, Texas  
*Towards topological phases via new ultracold matter: molecules and alkaline earths*  
September 2011
18. University of California, Davis condensed matter seminar, Davis, California  
*Spin liquids and non-quasiparticle matter in ultracold atoms,*  
February 2011

17. Berkeley AMO seminar, Berkeley, California  
*Spin liquids and non-quasiparticle matter in ultracold atoms*  
February 2011
16. Ludwig-Maximilians University/Max-Planck Institute for Quantum Optics seminar, Munich, Germany  
*Exploring the Mott/metal crossover in ultracold alkali and alkaline earth atoms in optical lattices*  
December 2010
15. Freiburg University FRIAS seminar, Freiburg, Germany  
*Exploring the Mott/metal crossover in ultracold alkali and alkaline earth atoms in optical lattices*  
November 2010
14. Stuttgart University seminar, Stuttgart, Germany  
*Exploring the Mott/metal crossover in ultracold alkali and alkaline earth atoms in optical lattices*  
November 2010
13. Institute for Theoretical Physics, University of Cologne seminar, Cologne, Germany  
*Exploring the Mott/metal crossover in ultracold alkali and alkaline earth atoms in optical lattices*  
November 2010.
12. IQOQI Cold Atoms Seminar, Innsbruck, Austria  
*Exploring the Mott/metal crossover in ultracold alkali and alkaline earth atoms in optical lattices*  
November 2010
11. DAMOP 2010 "Novel Probes of Ultra-Cold Atom Gases" session, Houston, Texas.  
*RF spectra of lattice bosons: a probe of correlations, fluctuations, and quantum criticality*  
May 2010
10. Ecole Normale Supérieure de Lyon colloquium, Lyon, France.  
*Measuring universal quantum critical behavior in ultracold gases*  
April 2010
9. Niels Bohr Institute Cold Atoms group meeting, Copenhagen, Denmark  
*Measuring universal quantum critical behavior in ultracold gases*  
April 2010
8. Harvard ITAMP AMO seminar, Boston, Massachusetts  
*Measuring universal quantum critical behavior in ultracold gases*  
March 2010
7. JILA/University of Colorado AMO/condensed matter seminar, Boulder, Colorado  
*Measuring universal quantum critical behavior in ultracold gases*  
March 2010

6. Princeton, Marlan Scully group meeting  
*Detecting many-body physics of quantum phase transitions in cold atoms*  
February 2010
5. DARPA optical lattice emulator program; Phase II kickoff, Miami, Florida  
*Probing quantum criticality in cold atoms*  
December 2009
4. Ohio State University, Wilkins group meeting.  
*Exploring many-body physics with cold atoms: achievements and challenges*  
July 2009
3. Centre for Quantum Computer Technology seminar, University of New South Wales, Sydney, New South Wales, Australia  
*Electrical Simulation of Quantum Algorithms*  
November 2003
2. Materials Computation Center seminar, University of Illinois Urbana-Champaign, IL  
*New small silicon interstitial clusters*  
July 2003
1. Semiconductor Research Corporation review, Seattle, WA  
*Dopant structures and their electronic properties.* (Substituting for P.I.)  
May 2003

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## Contributed presentations

Contributed over 40 talks and posters to meetings, conferences, and workshops.