

Ian B. Spielman

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Current research program

My current experiments lie at the intersection of condensed matter and atomic physics, realizing many-body systems with systems of ultra-cold atoms.

Current projects: (1) creating magnetic/optical configurations leading to synthetic gauge fields, for example, making the charge *neutral* bosons move like charged particles in a magnetic field, or act as if they experience the classic Rashba and Dresselhaus spin-orbit couplings; (2) using Feshbach resonances in ^{87}Rb to control interaction term in model Hamiltonians; (3) studying ultracold ^{87}Rb in an optical lattice, thus realizing the 2D Bose-Hubbard model; and (4) building a new experiment to study Bose-Fermi mixtures of ^{87}Rb and ^6Li .

Education and background

Ph.D. in Physics June 1998 – June 2004
California Institute of Technology; Pasadena, California
Thesis: “Evidence for the Josephson Effect in Quantum Hall Bilayers”

B.S. in Physics and Mathematics (Suma Cum Laude) Aug. 1994 – May 1998
University of Oklahoma; Norman, Oklahoma

Early background
Born on Feb. 24, 1976 in Sacramento, CA USA

Five most significant publications

1. *Spin-orbit-coupled Bose-Einstein condensates*; Y.-J. Lin, K. Jiménez-García, and I. B. Spielman; *Nature* **471** 83-86 (2011). Featured in: **Physics Today Search and Discovery, Physics world, and the online “Journal club for condensed matter physics.”**
2. *Synthetic magnetic fields for ultracold neutral atoms*; Y.-J. Lin, R. L. Compton, K. Jiménez-García, J. V. Porto and I. B. Spielman; *Nature* **462** 628-632 (2009). Featured in: **Physics Today, and the online “Journal club for condensed matter physics.”**
3. *A Bose-Einstein Condensate in a Uniform Light-induced Vector Potential*; Y.-J. Lin, R. L. Compton, A. R. Perry, W. D. Phillips, J. V. Porto and I. B. Spielman; *Phys. Rev. Lett.* **102**, 130401 (2009); **Featured in APS Physics Viewpoint.**

4. *The Mott insulator transition in a 2D atomic Bose gas*; I. B. Spielman, W. D. Phillips, and J. V. Porto; Phys. Rev. Lett. **98** 080404 (2007).
5. *Resonantly Enhanced Tunneling in a Double Layer Quantum Hall Ferromagnet*; I. B. Spielman, J. P. Eisenstein, L. N. Pfeiffer, and K. W. West; Phys. Rev. Lett. **84** 5808 (2000).

Research experience

Physicist Oct. 2006 – Present
National Institute of Standards and Technology; Gaithersburg, MD

Postdoctoral Researcher Aug. 2004 – Oct. 2006
National Institute of Standards and Technology; Gaithersburg, MD

Research on ultra cold atoms in optical lattices, focusing on condensed matter model systems. We focused very carefully on the superfluid to insulator transition in the realized 2D Bose-Hubbard model.

Postdoctoral Researcher July 2004
California Institute of Technology; Pasadena, CA

Studied the connection between coherent tunneling in quantum Hall bilayers and the local GaAs nuclear spin polarization.

Graduate Research Assistant Aug. 1998 – June 2004
California Institute of Technology; Pasadena, CA

Found evidence for an excitonic condensate via electron tunneling in GaAs heterostructures with large magnetic fields and at milli-Kelvin temperatures.

Undergraduate Research Assistant May 1997 – June 1998
University of Oklahoma; Norman, OK

Studied a possible metal insulator transition in 2d electron systems. Constructed gated IbSb samples. Work done for Dr. S. Q. Murphy.

Undergraduate Research Assistant Aug. 1995 – May 1997
University of Oklahoma; Norman, OK

Tested silicon micro-strip detectors for the CLEO and ATLAS projects.

Summer student June 1996 – Aug. 1996
University of Texas Science and Technology Center; Austin, TX

Calculations and design of a cylindrical RF plasma source for use in a GaN MBE system.

Summer student
Indiana University Cyclotron Facility; Bloomington, IN

June 1995 – Aug. 1995

Analyzed the data for the MEGA project, an experiment aimed at detecting non-conservation of lepton family number.

Teaching experience

Instructor

Aug. 2008 – Dec. 2008

Aug. 2007 – Dec. 2007

University of Maryland; College Park, MD

Co-taught the graduate level Atomic, molecular and optical physics class.

Graduate Teaching Assistant

March 2000 – June 2000

California Institute of Technology; Pasadena, CA

Graded for Ph103, an upper division class on mesoscopic physics.

Graduate Teaching Assistant

Aug. 1998 – June 1999

California Institute of Technology; Pasadena, CA

Taught the freshman computational physics series: Ph20a, b and c.

Peer-reviewed publications

1. *Spin-orbit coupling in atomic gases*; V. Galitski and I. B. Spielman; review, to appear Nature (2013).
2. *Measuring topology in a laser-coupled honeycomb lattice: From Chern insulators to topological semi-metals*; N. Goldman, E. Anisimovas, F. Gerbier, P. Ohberg, I. B. Spielman, G. Juzeliūnas; NJP **15** 013025 (2013). doi: 10.1088/1367-2630/15/1/013025
3. *Flux lattices reformulated*; G. Juzeliūnas and I. B. Spielman; NJP **14** 123022 (2012). doi:10.1088/1367-2630/14/12/123022
4. *Dynamically Slowed Collapse of a Bose-Einstein Condensate with Negative Scattering Length*; R. L. Compton, Y.-J. Lin, K. Jiménez-García, J. V. Porto, and I. B. Spielman; PRA **86** 063601 (2012). doi: 10.1103/PhysRevA.86.063601
5. *Observation of a superfluid Hall effect*; L. J. LeBlanc, K. Jiménez-García, R. A. Williams, M. C. Beeler, A. R. Perry, W. D. Phillips, and I. B. Spielman; PNAS **109** 10811-10814 (2012). doi: 10.1073/pnas.1202579109
6. *Synthetic 3D Spin-Orbit Coupling*; B. M. Anderson, G. Juzeliūnas, V. M. Galitski, and I. B. Spielman; Phys. Rev. Lett. **108**, 235301 (2012). **Featured as an Editors' Suggestion.**
7. *The Peierls substitution in an engineered lattice potential*; K. Jiménez-García, L. J. LeBlanc, R. A. Williams, M. C. Beeler, A. R. Perry, and I. B. Spielman; Phys. Rev. Lett. **108** 225303 (2012). **Featured as an Editors' Suggestion and in an APS Physics Viewpoint.**
8. *Synthetic Partial Waves in Ultracold Atomic Collisions*; R. A. Williams, L. J. LeBlanc, K. Jiménez-García, M. C. Beeler, A. R. Perry, W. D. Phillips, and I. B. Spielman; Science **335** 314-317 (2012).
9. *Spin-charge-density wave in a rounded-square Fermi surface for ultracold atoms*; D. Makogon, I. B. Spielman, and C. Morais Smith; Euro. Phys. Lett. **97** 33002 (2012). **Selected as an editors choice. Featured in Europhysics News.**
10. *Vortices in spin-orbit-coupled Bose-Einstein condensates*; J. Radic, T. Sedrakyan, I. B. Spielman, and V. Galitski; Phys. Rev. A **84** 063604 (2011). **Featured in PRA Kaleidoscope Images.**
11. *Chern numbers hiding in time-of-flight images*; E. Zhao, N. Bray-Ali, C. J. Williams, I. B. Spielman, and I. I. Satija; Phys. Rev. A **84** 063629 (2011).
12. *Spin-orbit-coupled Bose-Einstein condensates*; Y.-J. Lin, K. Jiménez-García, and I. B. Spielman; Nature **471** 83-86 (2011); Featured in: **Physics Today Search and Discovery, Physics world, and the online “Journal club for condensed matter physics.”**
13. *A synthetic electric force acting on neutral atoms*; Y.-J. Lin, R. L. Compton, K. Jiménez-García, W. D. Phillips, J. V. Porto and I. B. Spielman; Nature Physics **7** 531–534 (2011); **Featured in: Nature “Research Highlights” March 24, 2011.**
14. *Realistic Rashba and Dresselhaus spin-orbit coupling for neutral atoms*; D. L. Campbell, G. Juzeliūnas, and I. B. Spielman; Phys. Rev. A **84** 025602 (2011).

15. *Chiral Rashba spin textures in ultracold Fermi gases*; J. D. Sau, R. Sensarma, S. Powell, I. B. Spielman, and S. Das Sarma; Phys. Rev. B. Rapid **83** 140510 (2011); **Featured as an Editors' Suggestion.**
16. *Realistic Time-Reversal Invariant Topological Insulators with Neutral Atoms*; N. Goldman, I. Satija, P. Nikolic, A. Bermudez, M.A. Martin-Delgado, M. Lewenstein, and I. B. Spielman; Phys. Rev. Lett. **105** 255302 (2010).
17. *Phases of a 2D Bose Gas in an Optical Lattice*; K. Jiménez-García, R. L. Compton, Y.-J. Lin, W. D. Phillips, J. V. Porto and I. B. Spielman; Phys. Rev. Lett. **105** 110401 (2010).
18. *A slow atom source using a collimated effusive oven and a single-layer variable pitch coil Zeeman slower*; S. C. Bell, M. Junker, M. Jasperse, L. D. Turner, Y.-J. Lin, I. B. Spielman, and R. E. Scholten; Review of Scientific Instruments **81** 013105 (2010).
19. *Synthetic magnetic fields for ultracold neutral atoms*; Y.-J. Lin, R. L. Compton, K. Jiménez-García, J. V. Porto and I. B. Spielman; Nature **462** 628-632 (2009); **Featured in the online "Journal club for condensed matter physics."**
20. *Field-sensitive addressing and control of field-insensitive neutral-atom qubits*; N. Lundblad, J. M. Obrecht, I. B. Spielman, and J. V. Porto; Nature Physics **5** 575 (2009).
21. *Raman Processes and effective gauge fields*; I. B. Spielman; Phys. Rev. A **79** 063613 (2009).
22. *Quantum and Classical Dynamics of a BEC in a Large-Period Optical Lattice*; J. H. Huckans, I. B. Spielman, B. Laburthe Tolra, W. D. Phillips, and J. V. Porto; Phys. Rev. A **90** 043609 (2009); **Featured in PRA Kaleidoscope Images.**
23. *Rapid production of ^{87}Rb Bose-Einstein condensates in a combined magnetic and optical potential*; Y.-J. Lin, A. R. Perry, R. L. Compton, I. B. Spielman, and J. V. Porto; Phys. Rev. A **79** 063631 (2009).
24. *A Bose-Einstein Condensate in a Uniform Light-induced Vector Potential*; Y.-J. Lin, R. L. Compton, A. R. Perry, W. D. Phillips, J. V. Porto and I. B. Spielman; Phys. Rev. Lett. **102** 130401 (2009); **Featured in APS Physics Viewpoint.**
25. *Condensate fraction in a 2D Bose gas measured across the Mott-insulator transition*; I. B. Spielman, W. D. Phillips, and J. V. Porto; Phys. Rev. Lett. **100** 120402 (2008).
26. *Atoms in a radiofrequency-dressed optical lattice*; N. Lundblad, P. J. Lee, I. B. Spielman, B. L. Brown, W. D. Phillips, and J. V. Porto; Phys. Rev. Lett. **100** 150401 (2008).
27. *The Mott insulator transition in a 2D atomic Bose gas*; I. B. Spielman, W. D. Phillips, and J. V. Porto; Phys. Rev. Lett. **98** 080404 (2007).
28. *Collisional de-excitation in a quasi-2D degenerate Bose gas*; I. B. Spielman, P. R. Johnson, J. H. Huckans, C. D. Fertig, S. L. Rolston, W. D. Phillips, and J. V. Porto; Phys. Rev. A **73** 020702(R) (2006).
29. *Spin Transition in Strongly Correlated Bilayer Two Dimensional Electron Systems*; I. B. Spielman, L. A. Tracy, J. P. Eisenstein, L. N. Pfeiffer and K. W. West; Phys. Rev. Lett. **94** 076803 (2005).
30. *Onset of Interlayer Phase Coherence in a Bilayer Two-Dimensional Electron System: Effect*

- of Layer Density Imbalance*; I. B. Spielman, M. Kellogg, J. P. Eisenstein, L. N. Pfeiffer and K. W. West; Phys. Rev. B **70** 081303 (2004).
31. *Resistivity of dilute 2D electrons in an undoped GaAs heterostructure*; M. P. Lilly, J. L. Reno, J. A. Simmons, I. B. Spielman, J. P. Eisenstein, L. N. Pfeiffer, K. W. West, E. H. Hwang, and S. Das Sarma; Phys. Rev. Lett. **90** 056806 (2003).
32. *Observation of Quantized Hall Drag in a Strongly Correlated Bilayer Electron System*; M. Kellogg, I. B. Spielman, J. P. Eisenstein, L. N. Pfeiffer and K. W. West; Phys. Rev. Lett. **88** 126804 (2002).
33. *Observation of a Linearly Dispersing Goldstone Mode in a Quantum Hall Ferromagnet*; I. B. Spielman, J. P. Eisenstein, L. N. Pfeiffer, and K. W. West; Phys. Rev. Lett. **87** 036803 (2001).
34. *Resonantly Enhanced Tunneling in a Double Layer Quantum Hall Ferromagnet*; I. B. Spielman, J. P. Eisenstein, L. N. Pfeiffer, and K. W. West; Phys. Rev. Lett. **84** 5808 (2000).
35. *Kinetic Inductance of the Two-Dimensional Electron Gas*; P. J. Burke, I. B. Spielman, J. P. Eisenstein, L. N. Pfeiffer, and K. W. West; Appl. Phys. Lett. **76** 745 (2000).

Books and chapters

36. *Light induced gauge fields for ultracold neutral atoms*; I. B. Spielman; World Scientific Book Chapter (2012).

Invited publications

37. *Seeing topological order*; G. Juzeliūnas and I. B. Spielman; Physics **4** 99 (2011).
38. *An optical Lattice of Flux*; I. B. Spielman; Physics **4** 35 (2011).
39. *Atomic physics: A route to quantum magnetism*; I. B. Spielman; Nature **472** 301-302 (2011, News and Views article).

Other publications

40. *Formation of optical flux lattices for ultra cold atoms*; G. Juzeliunas and I. B. Spielman; Proc. SPIE **8274** 82740H (2012).
41. *Engineering Dresselhaus spin-orbit coupling for cold atoms in a double tripod configuration*; G. Juzeliūnas, J. Ruseckas, D. L. Campbell, I. B. Spielman; Proc. SPIE **7950** 79500M (2011).
42. *Synthetic electric and magnetic fields for ultracold neutral atoms*; W. D. Phillips, Y.-J. Lin, R. L. Compton, K Jiménez-García, A. R. Perry, J. V. Porto, and I. B. Spielman; J. Phys.: Conf. Ser. **264** 012002 (2011).

43. *Bilayer 2D electron systems at $\nu_T=1$: phase boundary between weak and strong coupling*; J. P. Eisenstein, M. Kellogg, I. B. Spielman, L. N. Pfeiffer, and K. W. West; *Physica E* **20** 111 (2003).
44. *Evidence of superfluidity in double layer 2D electron systems*; J. P. Eisenstein, I. B. Spielman, M. Kellogg, L. N. Pfeiffer, and K. W. West; *Physica E* **18** 103 (2003).
45. *Tunneling in a quantum Hall excitonic condensate*; J. P. Eisenstein, I. B. Spielman, L. N. Pfeiffer, and K. W. West; *Int. J. of Mod. Phys. B* **16** 2923 (2002).

Talks and posters

1. *Bose-Einstein condensates subject to synthetic gauge fields*: Mid-Atlantic senior physicists group seminar (2012).
2. *Gauge fields: progress report*: DARPA OLE Meeting, Miami (2012, programmatic).
3. *Bose-Einstein condensates subject to synthetic gauge fields*: Pennsylvania State University Physics colloquium (2012).
4. *Observation of zitterbewegung in a degenerate quantum gas*: Louisiana State University Physics colloquium (2012).
5. *Good times with artificial gauge fields*: KITP seminar (2012).
6. *Bose-Einstein condensates subject to synthetic gauge fields*: Princeton University Physics colloquium (2012).
7. *Zitterbewegung in a BEC*: Institute of Theoretical Physics and Astronomy of Vilnius University, special seminar (2012, invited).
8. *The Hall and the spin-Hall effects in a BEC*: Georgia Tech atomic physics seminar (2012, invited).
9. *The Hall and the spin-Hall effects in a BEC*: at ICAP Ecole polytechnique (2012, invited).
10. *Gauge fields with cold atoms*: at the “The frontiers of quantum matter symposium” hosted at George Mason University (2012, invited).
11. *Ultracold atoms: spin orbit coupling and engineered interactions*: APS DAMOP meeting (2012, invited).
12. *Spin-Orbit coupled atomic gases*: DARPA OLE Meeting (2012, programmatic).
13. *Bose-Einstein condensates in synthetic gauge fields*: International Workshop on Ultracold atoms/molecules”, hold by NCTS in Taiwan (2012, invited).
14. *The Hall and the spin-Hall effects in a BEC*: international conference in Hong Kong on “Frontiers of Cold Atoms and Related Topics” (2012, invited).
15. *Artificial magnetic fields in systems of ultracold atoms*: MIT physics department colloquium (2012, invited).
16. *Artificial magnetic fields in systems of ultracold atoms*: University of Maryland physics department colloquium (2012, invited).
17. *Artificial gauges fields and interactions with cold atoms*: APS March Meeting (2012, invited).
18. *Artificial gauges fields and interactions with cold atoms*: Aspen winter conference 2012: New Directions in Ultracold Atoms (2012, invited).
19. *Artificial gauge fields and interactions with cold*: Newspin winter school lecture, Texas A&M University (2011, invited).

20. *Majorana fermions with ultracold atoms: progress*: Microsoft Station Q meeting (2011, invited)
21. *Bose-Einstein condensates in synthetic gauge fields*: George Mason University physics department colloquium (2011, invited).
22. *Bose-Einstein condensates in synthetic gauge fields* or *Complexity from simplicity and back again*: U. of Pittsburgh physics department colloquium (2011, invited).
23. *Ultracold atoms: a new class of materials*: CIFAR meeting in Quebec (2011, invited).
24. *Bose-Einstein condensates in synthetic gauge fields* or *Complexity from simplicity and back again*: U. of Connecticut physics department colloquium (2011, invited).
25. *Bose-Einstein condensates in synthetic gauge fields*: Institute of Theoretical Physics and Astronomy of Vilnius University, special seminar (2011, invited).
26. Gauge-field fun with ultracold atoms: BEC 2011 Conference, Sant Feliu (2011, Invited, Prize session)
27. *Modified interactions: A tale of two colliding BEC's*: ICPEAC Meeting, Belfast Northern Ireland (2011, IUPAP prize talk).
28. *Complexity from simplicity and back again*: NIST SAA talk (2011, invited).
29. *Modified atomic interactions via laser dressing*: DARPA OLE Meeting, Vail (2011, programmatic).
30. *Bose-Einstein condensates in synthetic gauge fields*: Yale University condensed matter seminar (2011, invited).
31. *Gauge fields with cold atoms*: DPG School on quantum gases (2011, invited)
32. *Ultracold atoms: understanding complex systems through simplicity*: Rowan University Deans Lecture (2011, invited).
33. *Bose-Einstein condensates in synthetic gauge fields*: NIST Atomic Physics division seminar (2011, invited).
34. *Synthetic electromagnetism for cold atoms*: AAAS Annual Meeting, Matter-Wave Magic session (2011, invited).
35. *Artificial gauge fields for neutral atoms*: University of Texas, Austin, complex systems seminar (2011, invited).
36. *Gauge fields: progress report*: DARPA OLE Meeting, Miami (2010, programmatic).
37. *Artificial gauge fields for neutral atoms*: Caltech, colloquia (2010, invited).
38. *Practical prospects for non-abelian gauge fields*: KITP workshop (2010, invited).
39. *Gauge fields for ultracold atoms: abelian and otherwise*: UMD CMTC seminar (2010, invited).
40. *Artificial gauge fields for neutral atoms*: KITP conference (2010, invited).
41. *Artificial gauge fields for neutral atoms*: Princeton, condensed matter seminar (2010, invited).

42. *A Bose-Einstein condensate subject to synthetic gauge fields*: Special seminar, University of Oklahoma (2010, invited).
43. *A Bose-Einstein condensate subject to synthetic gauge fields*: Departmental colloquia, Oklahoma State (2010, invited).
44. *A Bose-Einstein condensate subject to synthetic gauge fields*: Workshop at Tsinghua University, Beijing (2010, invited).
45. *Gauge fields: abelian and otherwise*: L'PHYS 2010 Brazil (2010, Invited).
46. *Artificial fields: progress report*: DARPA OLE Meeting, Houston (2010, programmatic).
47. *Synthetic electromagnetism for Neutral atoms*: Center for Ultracold Atoms, Harvard/MIT (2010, invited).
48. *Good times with quantum physics*: Chicago "Pumping station one" (2010, public lecture).
49. *Synthetic electromagnetism for Neutral atoms*: University of Chicago, James Frank Institute seminar (2010, invited).
50. *Synthetic electromagnetism for Neutral atoms*: Yale University, condensed matter seminar (2010, invited).
51. *Synthetic electromagnetism for Neutral atoms*: Rice University, condensed matter seminar (2010, invited).
52. *Synthetic electromagnetism for Neutral atoms*: Virginia Tech departmental Colloquium (2010, invited).
53. *Ultracold atoms: engineered many-body systems*: IISER seminar, Kolkata India (2010, invited).
54. *Synthetic electromagnetism*: ICCIA10 meeting, Sankapur, India (2010, invited).
55. *Synthetic electromagnetism*: Exotic insulating states of matter, Johns Hopkins University (2010, invited).
56. *Synthetic electromagnetism*: Sigma Xi Young Scientist award seminar, NIST (2009, invited).
57. *Optical lattice emulator phase II*: DARPA OLE Kickoff, Miami (2009, programmatic).
58. *A synthetic magnetic field for neutral atoms*: KITPC focus session, Beijing (2009, invited).
59. *A synthetic magnetic field for neutral atoms*: JQI seminar (2009, invited).
60. *A synthetic magnetic field for neutral atoms*: ICREA meeting Sant Benet, Spain (2009, invited).
61. *A synthetic magnetic field for neutral atoms*: CIFAR meeting in Nova Scotia, Canada (2009, invited).
62. *Generation of a synthetic vector potential and an E field*: DAMOP (2009, invited).
63. *Measured phase diagram of the 2D Bose-Hubbard Hamiltonian*: DARPA Program review (2009, programmatic).
64. *Generation of a synthetic vector potential and an E field*: University of Utrecht, Netherlands

- condensed matter theory seminar (2009, invited).
65. *Generation of a synthetic vector potential and an E field*; Trieste, Italy conference (2009, invited).
 66. *Control of the energy-momentum relation in cold atom systems: effective vector potentials, and 2D Bosons in an optical lattice, $T > 0$* ; KITP conference and program two (2009, invited – two talks).
 67. *Control of the energy-momentum relation in cold atom systems: effective vector potentials*; ITAMP workshop (2009, invited).
 68. *Realization of the Bose-Hubbard model in non-standard lattice potentials: tools, experiments, and a simple model*; PQE at Snowbird (2009, invited).
 69. *Bose Hubbard in Rb at JQI*; DARPA Program review (2008, programmatic).
 70. *Designing the Hamiltonian*; Fundamentals in Optics meeting: young laser scientists session (2008, invited).
 71. *2D Bosons in an optical lattice*; Georgetown University physics colloquia (2008, invited).
 72. *Control of the energy-momentum relation in cold atom systems: effective vector potentials*; University of Illinois AMO/CMP seminar (2008, invited).
 73. *Control of the energy-momentum relation in cold atom systems: effective vector potentials*; University of Maryland CMP symposium (2008, invited).
 74. *2D Bosons in an optical lattice*; LPHYS'08 quantum information seminar (2008, invited).
 75. *Generation of effective magnetic fields in Raman-dressed states*; APS DAMOP meeting (2008, contributed).
 76. *Engineering Hamiltonians in position and momentum*; Max Planck Institute, Dresden (2008, invited).
 77. *Control of the energy-momentum relation in systems of ultra-cold atom*; Quantum Information Sciences meeting at NIST Boulder (2008, programmatic).
 78. *2D Bosons in an optical lattice*; Millersville University physics colloquia (2008, invited).
 79. *2D Bosons in an optical lattice*; University of Texas at Austin physics colloquia (2007, invited).
 80. *Cold atoms and the 2D Bose-Hubbard mode*; APS DAMOP meeting (2007, invited).
 81. *Measurements in a 2D Bose-Hubbard system*; NIST Atomic physics division seminar (2007).
 82. *Mott Insulator - Superfluid Transition in a 2D Bose Gas*; Kavli Institute for Theoretical physics (2007, invited).
 83. *Phases of 2D Bose-Hubbard systems*; APS March Meeting (2007, contributed).
 84. *Bose-Hubbard model in an optical lattice*; DARPA OLE presentation day (2006, poster).
 85. *Size of Mott domains measured by noise correlations*; APS March Meeting (2006, contributed).

86. *Bosons in a 2D optical lattice: an experimental study*; Sandia National Labs Condensed Matter Physics Seminar (2006).
87. *2D Bosons in an optical lattice*; Caltech CMP and AMO seminar (2006).
88. *2D Bosons in an optical lattice*; JQI seminar (2006).
89. *Bosons in a 2D optical lattice: an experimental study*; Boston College Condensed Matter Physics Seminar (2006).
90. *The onset of the $\nu = 1$ bilayer quantum Hall effect*; Boston College Special Condensed Matter Physics Lecture (2006).
91. *Size of Mott domains measured by noise correlations*; APS March Meeting (2006, contributed).
92. *Bosons in a 2D optical lattice: an experimental study*; Yale Solid State and Optics Seminar Series (2006).
93. *Bosons in a 2D optical lattice: an experimental study*; JILA Seminar (2006).
94. *Bosons in a 2D optical lattice: an experimental study*; MIT Seminar (2006).
95. *Bosons in a 2D optical lattice: an experimental study*; Princeton Solid State Seminar (2006).
96. *Lifetimes of excited quantum-mechanical states in a 2D BEC*; Towson University Physics Seminar (2005).
97. *Vibrational lifetimes in a 2D BEC*; Virginia Tech Condensed Matter Seminar (2005).
98. *Vibrational state lifetimes in a 1D optical lattice*; APS March Meeting (2005, contributed).
99. *Emergent Phenomena in Quantum Hall Systems* (2005, invited); PCCM Workshop on Strongly Correlated Electronic Materials (2005, invited).
100. *Indications of excitonic superfluidity in a quantum Hall bilayer*; 20th EPS CMD General Conference (2004, invited).
101. *Incomplete electronic spin polarization in the $\nu_T = 1$ bilayer quantum Hall state*; APS March Meeting (2004, contributed).
102. *New observations in a quantum Hall ferromagnet via tunneling spectroscopy*; NATO ASI at Windsor (2001, poster).
103. *Observation of a linearly dispersive Goldstone mode in a quantum Hall ferromagnet via tunneling spectroscopy*; APS March Meeting (2001, invited).
104. *Tunneling in a bilayer quantum Hall ferromagnet*; APS March Meeting (2000, contributed).

Outreach

1. Presented a series of demos on laser light at Rockville Science Day (2012).
2. Presented a series of demos on electromagnetism and sound at Rockville Science Day (2011).
3. Presented a series of demos on electromagnetism at Rockville Science Day (2010).

4. Gave a demo “Understanding magnetism” to 4-8 graders (Technology Day at Shady Grove Campus, Nov. 2010).

Mentored a high school student in the lab (Summer 2009); mentored numerous undergraduate students through NIST SURF program.

Service

Member of scientific advisory committee for Moore Foundation on emergent physics (Sep. 2012)
Served on organizing committee for NewSpin2 winter school at Texas A&M (Dec. 2011)

Local committee work

JQI executive committee (2012-present); JQI seminar series committee (2011-2012); JQI infrastructure committee (2008-present, Chairman from 2008-2010); JQI graduate fellowship committee (2009, 2010).

Review for

Nature, Science, Physical Review Letters, Physical Review A, New Journal of Physics, and Nature Physics.

Participated in review panels for granting agencies (specifics are confidential).

Honors

Professional

1. Elected as a Fellow of the American Physical Society (2012).
2. 2012 Kavli Fellow.
3. 2011 Junior BEC Award: For the first experimental realization of synthetic magnetic fields and spin-orbit couplings in atomic Bose-Einstein condensates.
4. 2011 IUPAP prize: the IUPAP Prize rewards a young researcher who has a leading personal role in the achievement of original and outstanding contributions to the field of AMO physics.
5. 2011 Arthur S. Flemming Award, recognizing distinguished service in the federal government. Citation: “For pioneering research in quantum physics, particularly the novel use of controlled quantum systems, specifically ultracold atomic gases, to model quantum phenomena that are difficult to observe in other settings.”
6. 2010 PECASE Award: Presidential Early Career Awards for Scientists and Engineers, the highest honor bestowed by the United States government on young professionals in the early stages of their independent research careers.
7. 2010 Maryland Academy of Sciences: Young scientist of the year award.

8. 2010 Popular Science Brilliant 10. Citation: “his manipulation of atoms chilled to near-absolute zero could help create high-temperature superconductors.”
9. 2009 NIST Bronze Metal. Citation: “For the development of methods to simulate condensed matter models by creating simple experimental realizations using ultra-cold atomic gases”
10. 2009 NIST Sigma Xi Young Scientist Award. Citation: “In recognition for your highly innovative studies of Bose-Einstein condensates in two-dimensional lattices.”
11. 2009 Finalist for “Call to Service Medal”. Citation: “Pioneered a new area of research that is helping scientists understand crucial, but currently intractable, mysteries of physics like the explanation of high-temperature superconductivity.”

Postdoctoral Honors (National Institute of Standards and Technology)

National Research Council Postdoctoral Associate: 2004-2006

Graduate Honors (California Institute of Technology)

National Defense Science and Engineering Graduate Fellowship: 1999-2002

Caltech karate club captain: 2001-2003.

Undergraduate Honors (University of Oklahoma)

Fowler Prize for the outstanding senior in physics and astronomy: 1998

Barry M. Goldwater scholar: 1997-1998

Phi Kappa Phi honors society: 1998

Clarence Kaucher award for outstanding achievement in physics: 1996

University of Oklahoma Physics Kaucher scholarship: 1995-1997