Daniel A. Steck

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Education

The University of Texas at Austin, 8/95 - 11/01

Ph.D. in Physics
Areas of specialization: experimental atom optics and quantum chaos
GPA: 4.00

University of Dayton, Dayton, Ohio, 8/91 - 5/95

B.S. in Physics and Mathematics (dual major)
GPA: 4.00, Summa Cum Laude

Awards and Honors

19. National Science Foundation CAREER award, 3/06-present
18. American Physical Society Division of Atomic, Molecular, and Optical Physics (DAMOP) Thesis Award, 5/03
17. Fannie and John Hertz Foundation Doctoral Thesis Prize, 3/03
16. 2002 Council of Graduate Schools/University Microfilms International Distinguished Dissertation Award in the field of Mathematics, Physical Sciences, and Engineering, 12/02
15. Outstanding Dissertation Award, Graduate School, The University of Texas at Austin, 5/02
14. Outstanding Dissertation Award, Department of Physics, The University of Texas at Austin, 5/02
13. Director-Funded Postdoctoral Fellowship, Los Alamos National Laboratory, 11/01-9/04
12. David Bruton, Jr. Fellowship (The University of Texas at Austin), 9/98 - 8/99
11. Fannie and John Hertz Foundation Graduate Fellowship, 8/98 - 6/01
10. National Science Foundation Graduate Research Fellowship, 8/95 - 8/98
9. Award of Excellence to a Senior Majoring in Physics (University of Dayton), 5/95
8. Faculty Award for Excellence in Mathematics (University of Dayton), 5/95
7. National Science Foundation Research Experience for Undergraduates (REU) Fellowship, 6/94 - 8/94
6. Council on Undergraduate Research (CUR) Academic-Industrial Undergraduate Research Partnership (AIURP) Fellowship, 5/93 - 8/93
5. Society of Physics Students Scholarship, 8/93
4. Caesar Castro Award (to an outstanding sophomore physics student at the University of Dayton), 4/93
3. Pi Mu Epsilon Award (to an outstanding sophomore mathematics student at the University of Dayton), 4/93
2. Full tuition scholarship, the University of Dayton, 8/91 - 5/95
1. National Merit Scholarship, 8/91 - 5/95

Research

Current Research. University of Oregon, Department of Physics and Oregon Center for Optics, Associate Professor, 9/10 - present; Assistant Professor, 9/04 - 9/10.

- My group has constructed an apparatus to laser cool and trap neutral rubidium atoms in optical dipole potentials. Our experiments thus far have realized and characterized a one-way barrier for cold atoms using laser light. This system is interesting not only as a new method for controlling the motion of atoms, but also as a literal realization of Maxwell's Demon. In the next set of experiments, we will trap single atoms in optical potentials to study quantum measurements, particularly the interplay of dynamical evolution with the measurement process, the quantum–classical transition, and quantum transport phenomena.

- We are beginning the construction of a second laser cooling and trapping apparatus for neutral strontium atoms. Using this apparatus we will apply technology developed for next-generation, optical atomic clocks to studying the quantum-vacuum potentials between atoms and surfaces (van der Waals and Casimir–Polder potentials) in novel regimes.

Postdoctoral Research. Los Alamos National Laboratory, Theoretical Division, 11/01 - 9/04.
Research advisor: Dr. Salman Habib.

- Theoretical and computational investigations of continuous quantum measurement and feedback control of atomic motion in cavity QED. Includes the development of algorithms for estimating and cooling atoms in an optical microcavity; parallel, Monte-Carlo simulations to test the cooling performance of the algorithms; development of an analytic theory to describe the steady-state temperatures; detailed analysis of timing and efficiency issues in an experimental implementation, including methods for improving the speed of the algorithm and methods to compensate for limitations of current computational hardware; and direct testing of the adiabatic approximation via full simulations of the coupled atom-cavity dynamics.

- Theoretical and computational investigations of Casimir-type effects, including the development of a parallel, high-performance code to compute vacuum energies and energy densities for fields constrained by boundaries of arbitrary shape.

- Computational investigations of Bose-Einstein condensate (BEC) dynamics, including the collapse of BECs with attractive self-interactions and the nature of nonlinear BEC motion. Includes the development of parallel, high-performance codes for the BEC simulations.

- Experience setting up and managing two Beowulf-class Linux clusters.

Doctoral Research. The University of Texas at Austin, Department of Physics, 8/95 - 11/01.
Research advisor: Prof. Mark G. Raizen.

- Experimental investigations of quantum chaos, quantum transport, and decoherence in atom optics, addressing fundamental questions at the border between classical and quantum mechanics.

- Major experimental achievements include the direct observation of chaos-assisted tunneling, the observation of noise effects on quantum dynamical localization in the kicked rotor (a textbook system

in the study of classical and quantum chaos), and a quantitative study of the quantum–classical transition due to applied noise in the kicked rotor.

- Worked closely with other group members to construct and operate new, custom experimental apparatus, which prepared ultracold cesium atoms using a magneto-optic trap, further cooling in a 3-D optical lattice, and velocity-selective stimulated Raman transitions. Involved in all aspects of the experiment, including the design, construction, and operation of stabilized diode laser systems and a Ti:sapphire ring laser; the ultra-high vacuum system; analog, digital, and RF circuit design and fabrication; precision electronic timing and control; and mechanical design and precision machining.
- Construction of a detailed classical model of the experimental apparatus for direct quantitative comparison of simulations with experimental data. Also, extensive quantum simulations of the experiment to assist in analysis and interpretation of data.

Research Interests

- Measurement and control of quantum systems.
- Quantum nonlinear dynamical systems, including dynamics of Bose-Einstein condensates.
- Quantum chaos and the quantum–classical transition.
- QED effects, including cavity QED and Casimir-type forces.
- Physics of cold atoms, including atom cooling and trapping methods.
- Mathematical modeling of biological systems, particularly human ecological behavior.

Teaching

University of Oregon. Assistant Professor, 2004-2010; Associate Professor, 2010-present.

- **AY 2010-11:** Physics of Sound and Music (PHYS 152, Fall 2010).
- **AY 2009-10:** Physics of Sound and Music (PHYS 152, Fall 2009); Quantum Optics II (PHYS 685, Winter 2010); Computational Quantum Optics (PHYS 686, Spring 2010). Course notes available online at http://steck.us/teaching.
- **AY 2008-9:** Physics of Sound and Music (PHYS 152, Fall 2008); The Physics Behind the Internet (PHYS 155, Winter 2009); Recent Developments in Quantum Optics and Quantum Information (PHYS 610, Spring 2009). Course notes available online at http://steck.us/teaching.
- **AY 2007-8:** Quantum Optics (PHYS 684, Fall 2007); Quantum Optics II (PHYS 685, Winter 2008); Numerical Quantum Optics (PHYS 686, Spring 2008). Course notes available online at http://steck.us/teaching.
- **AY 2006-7:** Quantum Optics (PHYS 684, Fall 2006); Quantum Optics II (PHYS 685, Winter 2007); Numerical Quantum Optics (PHYS 686, Spring 2007). Course notes available online at http://steck.us/teaching.
- **AY 2005-6:** Classical and Modern Optics (PHYS 424/524, Winter 2006); Photonics (PHYS 425/525, Spring 2006). Course notes available online at http://steck.us/teaching.
- **AY 2004-5:** Classical and Modern Optics (PHYS 424/524, Winter 2005); Modern Optics Laboratory (PHYS 425/525, Spring 2005).

- **Students supervised (Ph.D.):**
    1. Matthew Briel (6/10-present)
    2. Eryn Cook (6/08-present)
    3. David Grych (temporary, 6/11-9/11)
    4. Jonathan Mackrory (12/08-present)
    5. Paul Martin (6/08-present)
    6. Rick Montgomery (temporary, 6/08-9/08)
    7. Yupeng Kong (temporary, 6/05-9/05)
    8. Tao Li (9/04-7/08), thesis available online at http://atomoptics.uoregon.edu/publications.html.
    9. Elizabeth Schoene (9/04-present)
    10. Jeremy Thorn (9/04-present)
    11. Richard Wagner (6/10-present)

- **Students supervised (Master's):**
    1. Matthias Fuchs (6/05-6/06), thesis available online at http://atomoptics.uoregon.edu/publications.html.

- **Students supervised (undergraduate):**
    1. Sequoia Alba (6/06-6/08)
    2. Leslie Bicknell (UCORE program, 6/10-8/10)
    3. Finley Blackburn (6/10-8/10)
    4. Corey Bofill (6/10-6/11)
    5. Tobias Brown-Heft (UCORE program, 6/10-present)
    6. Jeremy Copperman (9/04-6/05)
    7. Ninnat Dangniam (12/10-6/11)
    8. Jamey Davis (UCORE program, 6/08-8/08)
    9. Eli Dickison (UCORE program, 6/09-8/09)
    10. Keith Fannin (UCORE program, 6/11-8/11)
    11. Noah Fitch (NSF REU, 6/05-8/05)
    12. Jeffrey Garman (9/07-12/07)
    13. Jason Goff (6/07-9/09)
    14. Josh Kaufman (Los Alamos Summer School 6/03-8/03)
    15. Ian Kelly–Morgan (6/07-9/08)
    16. Cody Leary (Los Alamos Summer School 6/02-8/02)
    17. Corey Richter (UCORE program, 6/09-8/09)
    18. Yonatan Schultz (6/06-12/06)
    19. John Smith (UCORE program, 6/11-8/11)
    20. Alice Tasker (6/08-6/10)
    21. Aaron Webster (6/05-5/07)
    22. Chris Vergara (6/10-present)
    23. Joe Voss (1/10-present)

- **Students supervised (other):**
    1. Peter Gaskell (postbaccalaureate, 9/04-8/07)

Los Alamos Summer School. Los Alamos National Laboratory, summers 2002-04.

- Lecturer and research mentor as part of 10-week summer school program for advanced undergraduates.

Physics Laboratory Instructor. University of Dayton, Department of Physics, 8/92 - 4/93.

- Taught laboratory sections for students with non-science majors.

Professional Service

Program committee. IQEC/CLEOPR 2011 (International Conference on Quantum Electronics/Conference on Lasers and Electro-Optics Pacific Rim), Sydney, Australia, 29 August–1 September 2011 (subcommittee on quantum optics).

Program subcommittee chair. 2011 CLEO/QELS (Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science Conference), Baltimore, MD, 1–6 May 2011 (subcommittee on Quantum Optics of Atoms, Molecules, and Solids).

Program committee. 2010 Annual Meeting of the Northwest Section of the American Physical Society, Walla Walla, WA, 1–2 October 2010.

Program committee. 2010 CLEO/QELS (Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science Conference), San Jose, CA, 16–21 May 2010 (subcommittee on Quantum Optics of Atoms, Molecules, and Solids).

Site-Visit Review Panelist. National Science Foundation, Harvard/MIT Center for Ultracold Atoms, Cambridge, Massachusetts, May 2009.

Session Chair. Southwest Quantum Information and Technology (SQuInT) Network Eleventh Annual Meeting, Seattle, WA, 19–22 February 2009, Quantum Measurement session.

Local organizer. PRACQSYS 2008 (The Principles and Applications of Control in Quantum Systems), Eugene, OR, 25–27 August 2008.

Program committee. 2007 CLEO/QELS (Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science Conference), Baltimore, MD, 6–11 May 2007 (subcommittee on Quantum Optics and Quantum Information).

Session Chair. 2007 CLEO/QELS (Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science Conference), Baltimore, MD, 6–11 May 2007, Session QThJ.

Retreat co-organizer. Oregon Center for Optics 2006 Annual Retreat, Eugene, OR, 14–15 February 2006.

Program committee. 2005 Annual Meeting of the Northwest Section of the American Physical Society, Victoria, BC, Canada, 13–14 May 2005 (atomic, molecular, optical, and chemical physics subgroup).

Conference co-organizer. Southwest Quantum Information and Technology (SQuInT) Network Fifth Annual Meeting, Santa Fe, NM, 7–9 February 2003.

Workshop co-organizer. Quantum Enabled Science and Technology (QUEST) 2002-2004 Annual Summer Workshops, Santa Fe, NM.

Referee for:

- *American Journal of Physics*
- American Physical Society (*Physical Review Letters, A, B, and E; Reviews of Modern Physics*)
- *The European Physical Journal D – Atomic, Molecular and Optical Physics*
- *Journal of Optics B: Quantum and Semiclassical Optics*
- Natural Sciences and Engineering Research Council of Canada
- National Science Foundation, Atomic, Molecular, and Optical Physics and Condensed Matter Physics programs
- *New Journal of Physics*
- Research Corporation
- *Quantum Information & Computation*
- *Review of Scientific Instruments* (acknowledged as an "outstanding and exceptional referee" in 2010, at http://rsi.aip.org/referee_acknowledgment_for_2010.)
- *Science*

Outreach. Participant in the AIP's 2005 "Adopt a Scientist" program.

Professional Affiliations

American Physical Society. 7/99–present.

American Association of Physics Teachers. 9/95–present.

Optical Society of America. 8/04–present.

Grants

7. "Measurement-Driven Quantum Dynamics and the Quantum–Classical Transition with Ultracold Atoms," National Science Foundation, beginning 7/11. Total award: $420,000 over three years.
6. "Ultracold Atoms as a Probe of Novel Atom–Surface Interactions," National Science Foundation, beginning 8/09. Total award: $410,000 over three years.
5. "Frontiers of Photonics: Advanced Laboratory Training in Nonlinear, Quantum, and Integrated Optics," 2006 Intel Faculty Fellowship Awards. With Steve Gregory and Hailin Wang, $50,000 for new modules in the University of Oregon Optics Teaching Laboratory.
4. National Science Foundation Research Experience for Undergraduates (REU) annual supplementary awards, for summers 2006-2009. Total from four awards: $40,000.
3. "Continuous Measurements of Quantum Dynamical Systems," National Science Foundation CAREER award, beginning 3/06. Total award: $570,576 over five years.

2. "Acquisition of Instrumentation for Multidisciplinary Experimental and Theoretical Research in Quantum Information and Quantum Control," National Science Foundation Major Research Instrumentation program, beginning 7/05. One of 10 named participants and lead co-PI for the portion of $211,000 for a Beowulf-class workstation cluster.

1. "Bose-Einstein condensate physics: dynamics and applications," Los Alamos National Laboratory LDRD DR program, beginning 10/03. One of 10 named participants, for a total of $4.3M over three years.

Refereed Publications

24. Mark G. Raizen and Daniel A. Steck, "Cold atom experiments in quantum chaos," (submitted to *Scholarpedia*).

23. Kurt Jacobs and Daniel A. Steck, "Engineering Quantum States, Nonlinear Measurements, and Anomalous Diffusion by Imaging," *New Journal of Physics* **13**, 013016 (2011). Also available as arXiv preprint 1008.4121. DOI: 10.1088/1367-2630/13/1/013016.

22. I. Lizuain, J. Echanobe, A. Ruschhaupt, J. G. Muga, and D. A. Steck, "Structural and dynamical aspects of avoided crossing resonances in a 3-level Λ system," *Physical Review A* **82**, 065602 [4 pages] (2010). Also available as arXiv preprint 1008.2078. DOI: 10.1103/PhysRevA.82.065602.

21. Jonathan B. Mackrory, Kurt A. Jacobs, and Daniel A. Steck, "Reflections from quantum measurements," *New Journal of Physics* **12**, 113023 [25 pages] (2010). Includes online data animations. Also available as arXiv preprint 1009.4968. DOI: 10.1088/1367-2630/12/11/113023.

20. Elizabeth A. Schoene, Jeremy J. Thorn, and Daniel A. Steck, "Cooling atoms with a moving one-way barrier," *Physical Review A* **82**, 023419 [5 pages] (2010). Also available as arXiv preprint 1012.3207. DOI: 10.1103/PhysRevA.82.023419.

19. Peter E. Gaskell, Jeremy J. Thorn, Sequoia Alba, and Daniel A. Steck, "An open-source, extensible system for laboratory timing and control," *Reviews of Scientific Instruments* **80**, 115103 [10 pages] (2009). DOI: 10.1063/1.3250825.

18. Jeremy J. Thorn, Elizabeth A. Schoene, Tao Li, and Daniel A. Steck, "Dynamics of cold atoms crossing a one-way barrier," *Physical Review A* **79**, 063402 [19 pages] (2009). Also available as arXiv preprint 0903.3635. DOI: 10.1103/PhysRevA.79.063402. (4 citations)

17. Jeremy J. Thorn, Elizabeth A. Schoene, Tao Li, and Daniel A. Steck, "Experimental Realization of an Optical One-Way Barrier for Neutral Atoms," *Physical Review Letters* **100**, 240407 [4 pages] (2008). Also available as arXiv preprint 0802.1585. DOI: 10.1103/PhysRevLett.100.240407. (21 citations)

    Media coverage of this paper:

    (a) *PRL* "Editor's Suggestion."

    (b) Kate Mcalpine, "Physicist's atom-sorting 'demon' created with lasers," *New Scientist* **198** No. 2661, 14 (21 June 2008).

    (c) Davide Castelvecchi, "One-way gate mimics 'demon' to trap atoms," *Science News* **174** No. 2, 7 (19 July 2008) (Web version, "Left in the Cold," 20 June, 2008, at http://www.sciencenews.org/view/generic/id/33454/title/Left_in_the_cold_).

    (d) David Voss, "Cold atoms on a one-way ticket," *Physics* (14 July 2008), http://physics.aps.org/synopsis-for/10.1103/PhysRevLett.100.240407.

(e) Adela Marian and Bretislav Friedrich, "News & Views: Maxwell's demon opens new doors," *Nature Photonics* **2**, 463 (2008) DOI: 10.1038/nphoton.2008.145.

(f) John Wallace, "Asymmetric optical potential barrier becomes Maxwell's demon," *Laser Focus World*, **44** (November 2008), available online at http://www.laserfocusworld.com/display_article/343857/12/none/none/NBrea/Asymmetric-optical-potential-barrier-becomes-Maxwells-demo.

(g) P.-M. Binder, "*Science* Perspectives: Reflections on a Wall of Light," *Science* **322**, 1334 (2008) DOI: 10.1126/science.1166681.

16. Kevin A. Mitchell and Daniel A. Steck, "Fractal templates in the escape dynamics of trapped ultracold atoms," *Physical Review A* **76**, 031403(R) [4 pages] (2007). Also available on arXiv as physics/0612052. DOI: 10.1103/PhysRevA.76.031403. (3 citations)

15. Kurt Jacobs and Daniel A. Steck, "A Straightforward Introduction to Continuous Quantum Measurement," *Contemporary Physics* **47**, 279-303 (2006). Also available as arXiv preprint quant-ph/0611067. DOI: 10.1080/00107510601101934. (41 citations)

14. Daniel A. Steck, Kurt Jacobs, Hideo Mabuchi, Salman Habib, and Tanmoy Bhattacharya, "Feedback cooling of atomic motion in cavity QED," *Physical Review A* **74**, 012322 [21 pages] (2006). Also available as arXiv preprint quant-ph/0509039 and LANL Release LA-UR-04-4687. DOI: 10.1103/PhysRevA.74.012322. (15 citations)

13. Daniel A. Steck, Kurt Jacobs, Hideo Mabuchi, Tanmoy Bhattacharya, and Salman Habib, "Quantum Feedback Control of Atomic Motion in an Optical Cavity," *Physical Review Letters* **92**, 223004 [4 pages] (2004). Includes auxiliary material and data animations in the EPAPS repository. Also available as arXiv preprint quant-ph/0310153 and LANL Release LA-UR-03-6826. DOI: 10.1103/PhysRevLett.92.223004. (40 citations)

12. Windell H. Oskay, Daniel A. Steck, and Mark G. Raizen, "Observation of Cumulative Spatial Focusing of Atoms," *Physical Review Letters* **89**, 283001 [4 pages] (2002). DOI: 10.1103/PhysRevLett.89.283001. (8 citations)

    Media coverage of this paper:

    (a) Phillip Espinasse, "Atom focusing gets its kicks," *OE Magazine*, March 2003, p. 10.

11. Windell H. Oskay, Daniel A. Steck, and Mark G. Raizen, "Timing Noise Effects on Dynamical Localization," *Chaos, Solitons and Fractals* **16**, 409-16 (2003). DOI: 10.1016/S0960-0779(02)00302-8. (16 citations)

10. Daniel A. Steck, Windell H. Oskay, and Mark G. Raizen, "Fluctuations and Decoherence in Chaos-Assisted Tunneling," *Physical Review Letters* **88**, 120406 [4 pages] (2002). DOI: 10.1103/PhysRevLett.88.120406. (38 citations)

9. Daniel A. Steck, Windell H. Oskay, and Mark G. Raizen, "Observation of Chaos-Assisted Tunneling between Islands of Stability," *Science* **293**, 274-8 (2001); published online 5 July 2001 (10.1126/science.1061569). Supplementary material is available at http://www.sciencemag.org/cgi/content/full/1061569/DC1. DOI: 10.1126/science.1061569. (156 citations)

    Media coverage of this paper:

    (a) Salman Habib, "*Science* Perspectives: No Mere Anarchy," *Science* **293**, 221 (2001); published online 5 July 2001 (10.1126/science.1062985).

    (b) Eric J. Heller, "Air juggling and other tricks," *Nature* **412**, 33 (2001).

(c) Barbara Goss Levi, "Atoms Hop between Islands of Regular Motion in a Sea of Chaos," *Physics Today*, August 2001, p. 15.

(d) Amaury Mouchet and Denis Ullmo, "Chaos gives quantum tunnelling a hand," *Physics World*, September 2001, p. 24.

(e) Mark Sincell, "Atoms Island-Hop," *ScienceNOW* – 2001 (706): 1.

(f) Katie Pennicott, "Atoms perform a quantum flip," *PhysicsWeb News*, 5 July 2001.

(g) Nicole Stricker, "Quantum wizardry: New research turns a bright light on atoms' tunneling phenomenon," *The Dallas Morning News*, 30 July 2001, p. 3C.

8. Jianxin Zhong, R. B. Diener, Daniel A. Steck, Windell H. Oskay, Mark G. Raizen, Zhenyu Zhang, E. Ward Plummer, and Qian Niu, "The Shape of the Quantum Diffusion Front," *Physical Review Letters* **86**, 2485 [4 pages] (2001). DOI: 10.1103/PhysRevLett.86.2485. (16 citations)

7. Daniel A. Steck, Valery Milner, Windell H. Oskay, and Mark G. Raizen, "Quantitative study of amplitude noise effects on dynamical localization," *Physical Review E* **62**, 3461-75 (2000). DOI: 10.1103/PhysRevE.62.3461. (41 citations)

6. V. Milner, D. A. Steck, W. H. Oskay, and M. G. Raizen, "Recovery of classically chaotic behavior in a noise-driven quantum system," *Physical Review E* **61**, 7223-6 (2000). DOI: 10.1103/PhysRevE.61.7223. (24 citations)

5. W. H. Oskay, D. A. Steck, V. Milner, B. G. Klappauf, and M. G. Raizen, "Ballistic peaks at quantum resonance," *Optics Communications* **179**, 137-48 (2000). DOI: 10.1016/S0030-4018(00)00453-3. (44 citations)

4. B. G. Klappauf, W. H. Oskay, D. A. Steck, and M. G. Raizen, "Quantum chaos with cesium atoms: pushing the boundaries," *Physica D* **131**, 78-89 (1999). DOI: 10.1016/S0167-2789(98)00221-8. (30 citations)

3. W. H. Oskay, D. A. Steck, B. G. Klappauf, and M. G. Raizen, "Quantum Chaos with Cold Cesium Atoms," *Laser Physics* **9**, 265-9 (1999). (4 citations)

2. B. G. Klappauf, W. H. Oskay, D. A. Steck, and M. G. Raizen, "Experimental Study of Quantum Dynamics in a Regime of Classical Anomalous Diffusion," *Physical Review Letters* **81**, 4044-7 (1998). DOI: 10.1103/PhysRevLett.81.4044. (57 citations)

1. B. G. Klappauf, W. H. Oskay, D. A. Steck, and M. G. Raizen, "Observation of Noise and Dissipation Effects on Dynamical Localization," *Physical Review Letters* **81**, 1203-6 (1998); Erratum, *Physical Review Letters* **82**, 241 (1999). DOI: 10.1103/PhysRevLett.81.1203. (100 citations)

   Media coverage of this paper:

   (a) Graham P. Collins, "The World of Quantum Chaos," *Physical Review Focus* **2**, story 8 (10 August 1998).

   (b) Meher Antia, "Action at the Classical-Quantum Border," *InSCIght* (27 August 1998).

Popular-Science Articles

2. Daniel A. Steck, "Passage through chaos," *Nature* **461**, 736 (2009). DOI: 10.1038/461736a.

1. Daniel A. Steck, "Paralysed by disorder," *Nature* **453**, 866 (2008). DOI: 10.1038/453866a.

Book Chapters

3. Daniel A. Steck and Mark G. Raizen, "Chaos-Assisted Dynamical Tunneling of Ultracold Atoms," in *Dynamical Tunneling—Theory and Experiment*, Srihari Keshavamurthy and Peter Schlagheck, Eds. (invited/refereed book chapter), pp. 37-74 (2010).

2. (in progress:) Daniel A. Steck, "Quantum Measurement and Feedback Control of Atomic Motion," in *The Oxford Handbook of Quantum Control: A Contemporary Perspective*, Daniel Lidar and Gerard Milburn, Eds. (invited book chapter, to be published by Oxford University Press in 2009).

1. M. G. Raizen, V. Milner, W. H. Oskay, and D. A. Steck, "Experimental Study of Quantum Chaos with Cold Atoms," in *Proceedings of the International School of Physics "Enrico Fermi," Course CXLIII (20-30 July 1999): New Directions in Quantum Chaos*, G. Casati, I. Guarneri, and U. Smilansky, Eds. (IOS Press, Amsterdam, 2000).

Other Publications

2. Salman Habib, Tanmoy Bhattacharya, Andrew Doherty, Benjamin Greenbaum, Asa Hopkins, Kurt Jacobs, Hideo Mabuchi, Keith Schwab, Kosuke Shizume, Daniel Steck, and Bala Sundaram, "Nonlinear Quantum Dynamics," arXiv preprint quant-ph/0505046.

1. Daniel Adam Steck, "Quantum Chaos, Transport, and Decoherence in Atom Optics," Ph.D. dissertation, The University of Texas at Austin (2001). Available online at `http://steck.us/dissertation`.

Selected Unpublished Works

3. Daniel A. Steck, *Quantum and Atom Optics*, available online at `http://steck.us/teaching`; course text suitable for a three-quarter sequence in quantum optics atom optics, and atomic physics (with additional material still being added), from classical and semiclassical atom-field interactions to field quantization, quantum-measurement theory, and numerical methods. Many exercises and figures, 730 pages total (828 pages in the version with solutions to exercises).

2. Daniel A. Steck, *Classical and Modern Optics*, available online at `http://steck.us/teaching`; course text suitable for a two-quarter sequence in modern optics, from geometrical optics through Fourier optics, laser oscillation, and atom optics. Many exercises and figures, 276 pages total (358 pages in the version with solutions to exercises).

1. Daniel A. Steck, "Cesium D Line Data," available online at `http://steck.us/alkalidata`; extensive, periodically updated compilation of atomic data relevant to quantum optics and atom optics experiments involving cesium, along with a thorough and consistent theoretical framework for the tabulated quantities. Also available as "Sodium D Line Data," "Rubidium 87 D Line Data," and "Rubidium 85 D Line Data." (These documents together average 26.1 downloads per day.)

Invited Talks

48. "Continuous Measurement of the Position of a Single Cold Atom: Towards the Quantum-Classical Transition," 12th Experimental Chaos and Complexity Conference, Ann Arbor, MI, 16–19 May 2012.

47. "TBA," Quantum Information Seminar, University of New Mexico, TBA.

46. "Controlling the Motion of Ultracold Atoms" (physics seminar), "Chaos, Quantum Mechanics, and Cooling Atoms with Laser Light" (public lecture), "Optical Lattices and the Casimir–Polder Effect" (workshop lecture), "Dynamics Under Continuous Position Measurements" (workshop lecture), Arfken Scholar lecture series, Miami University, 7-11 November 2011.

45. "Atomic One-Way Barriers and Quantum Measurements," Department Colloquium, Washington State University, 16 November 2010.

44. "Atomic One-Way Barriers and Quantum Measurements," Optical Sciences Colloquium, University of Arizona, 21 October 2010.

43. "Dynamics Under Continuous Position Measurements," QUEST 2010 Workshop, Santa Fe, NM, 23–27 August 2010.

42. "Atomic One-Way Barriers and Quantum Measurements," Quantum Information and AMO Seminar, University of Illinois at Urbana–Champaign, 28 April 2010.

41. "Atomic One-Way Barriers and Quantum Measurements," Quantum Optics and AMO Seminar, University of Toronto, 25 January 2010.

40. "Atomic One-Way Barriers and Quantum Measurements," Atomic Physics Seminar, University of Washington, 20 October 2009.

39. "Atomic One-Way Barriers and Quantum Measurements," Atomic, Molecular and Optical Physics Seminar, University of British Columbia, 24 September 2009.

38. "Controlling the Motion of Ultracold Atoms" and "One-Way Optical Barriers for Atoms: an In-Depth Look," Workshop on "Demons in Physics: Quantum Valves & One-Way Barriers," Universidad del País Vasco, Bilbao, Spain, 24–25 June 2009.

37. "Controlling the Motion of Ultracold Atoms," 11th Annual Meeting of the American Physical Society Northwest Section, Vancouver, British Columbia, 15–16 May 2009.

36. "All-Optical One-Way Barrier for Alkali Atoms," Solid State Physics and Optics Seminar, Oregon State University, 11 February 2009.

35. "Controlling the Motion of Ultracold Atoms," Physics Department Seminar, Reed College, 28 January 2009.

34. "All-Optical One-Way Barrier for Alkali Atoms," 39th Winter Colloquium on The Physics of Quantum Electronics, Snowbird, Utah, 4–9 January 2009.

33. "Controlling the Center-of-Mass Motion of Ultracold Atoms," Natural Sciences Seminar, University of California, Merced, 7 November 2008.

32. "Controlling the Motion of Ultracold Atoms," Joint Fall 2008 Meeting of the New England Sections of the American Physical Society and the American Aassociation of Physics Teachers, Boston, Massachusetts, 10–11 October 2008.

31. "Controlling the Center-of-Mass Motion of Ultracold Atoms," Atomic, Molecular, and Optical Physics Seminar, University of Connecticut, 9 October 2008.

30. "Controlling the Center-of-Mass Motion of Ultracold Atoms," Physics Department Colloquium, University of Nevada, Reno, 26 September 2008.

29. "Controlling the Center-of-Mass Motion of Ultracold Atoms," 2008 Canadian Institute for Advanced Research (CIFAR) Cold Atoms workshop, Banff, Alberta, Canada, 17–20 April 2008 (keynote speaker).

28. "Measurement and Control of Ultracold Atoms," Physics Department Colloquium, Linfield College, 3 April 2008.

27. "Measurement and Control of Atomic Motion," Quantum Lunch seminar, Los Alamos National Laboratory, 27 March 2008.

26. "Continuous Measurement of Atomic Motion," 2007 Quantum Control Gordon Research Conference, Newport, Rhode Island, 12–17 August 2007.

25. "Continuous Measurement of Atomic Motion," Coherent Control of Ultracold Molecular Processes Workshop, Vancouver, British Columbia, 1–4 August 2007.

24. "Continuous Measurement of Atomic Motion," 2007 Principles and Applications of Control in Quantum Systems (PrACQSys) Workshop, Sydney, Australia, 9–13 July 2007.

23. "Continuous Measurement of Atomic Motion," 9th Annual Meeting of the American Physical Society Northwest Section, Pocatello, Idaho, 17–19 May 2007.

22. "Continuous Measurement of Atomic Motion," AMO Physics Seminar, University of British Columbia, Vancouver, BC, 26 March 2007.

21. "Continuous Measurement of Atomic Motion," 37th Winter Colloquium on The Physics of Quantum Electronics, Snowbird, Utah, January 2–6, 2007.

20. "Chaos, the Quantum Vacuum, and Quantum Measurement in Atom Optics," QUEST 2006 Summer Workshop, Santa Fe, NM, 21–25 August 2006.

19. "Quantum Measurement and Control of Atomic Motion," Atomic Physics Seminar, University of Washington, 7 February 2006.

18. "Physics of Single, Trapped Neutral Atoms," Quantum Lunch seminar, Los Alamos National Laboratory, 30 November 2005.

17. "Quantum Measurement and Control of Atomic Motion," Solid State Physics/Optics Seminar, Oregon State University, 12 October 2005.

16. "Quantum Chaos in Atom Optics" and "Quantum Control in Atom Optics," TRIUMF Summer Institute 2005, Vancouver, British Columbia, 11–22 July 2005.

15. "Quantum Control in Atom Optics," Spring 2005 Meeting of the Ohio Section of the American Physical Society, Dayton, Ohio, 8–9 April 2005 (plenary session).

14. "Quantum Control in Atom Optics: Present and Future," colloquium, Wesleyan University, 21 October 2004.

13. "Quantum Feedback Control of Atomic Motion in Cavity QED," New Laser Scientist Conference, Rochester, New York, 15–16 October 2004.

12. “Quantum Feedback Control of Atomic Motion in Cavity QED,” seminar, Universidade Federal do Rio de Janeiro, 23 August 2004.

11. “Fluctuations and Decoherence in Chaos-Assisted Tunneling,” March 2004 Meeting of the American Physical Society, Montreal, Canada, 22–26 March 2004, paper H7.002. Published in *Bull. Am. Phys. Soc.* **49**, No. 1, 358 (2004).

10. “Quantum Control in Atom Optics: Present and Future,” seminar, University of British Columbia, 18 March 2004.

9. “Quantum Control in Atom Optics: Present and Future,” colloquium, University of Oregon, 5 February 2004.

8. “Quantum Feedback Control of Atomic Motion in Cavity QED,” colloquium, Universidad de Buenos Aires, 18 December 2003.

7. “Quantum Feedback Control of Atomic Motion in Cavity QED,” Quantum Lunch seminar, Los Alamos National Laboratory, 18 November 2003.

6. “Quantum Feedback Control of Atomic Motion in Cavity QED,” Atomic, Optical, and Molecular Science seminar, University of California, Berkeley, 22 October 2003.

5. “Quantum Feedback Control in Cavity QED,” seminar, University of Oxford, 5 September 2003.

4. “Chaos-Assisted Tunneling in Atom Optics,” 2003 Annual Meeting of the Division of Atomic, Molecular, and Optical Physics (DAMOP) of the American Physical Society, Boulder, Colorado, 20–24 May 2003, paper H1.004 (Thesis Award session). Published as *Bull. Am. Phys. Soc.* **48**, No. 3, 72 (2003).

3. “Chaos-Assisted Tunneling and Spatial Focusing of Atoms in Modulated Optical Lattices,” seminar, University of Arizona, 5 March 2003.

2. “Chaos-Assisted Tunneling,” QUEST 2001 Summer Retreat, Santa Fe, NM, 6-10 August 2001.

1. “Quantum Chaos Experiments with Cold Cesium Atoms,” seminar, University of Dayton, 29 April 1999.

Local Talks

11. “Measurement and Control of Ultracold Atoms,” colloquium, University of Oregon, 29 October 2009.

10. “Experimental Approaches for Studying the Casimir–Polder Effect,” Oregon Center for Optics 2007 Annual Fall Retreat, Eugene, Oregon, 13–14 September 2007.

9. “Why the Casimir–Polder Effect is both Beautiful and Infuriating,” Oregon Center for Optics 2006 Annual Fall Retreat, Eugene, Oregon, 14–15 September 2006.

8. “Physics of Single, Trapped Neutral Atoms,” Oregon Center for Optics 2005 Annual Fall Retreat, Eugene, Oregon, 7–9 September 2005.

7. “Classical and Quantum Chaos in Atom Optics,” UO Materials Science Institute Research Experience for Undergraduates (REU) Summer Program Seminar, Eugene, Oregon, 22 June 2005.

6. “Quantum Feedback Control in Atom Optics,” Institute of Theoretical Science Seminar, University of Oregon, 1 March 2005.

5. "Classical and Quantum Chaos in Atom Optics," Natural Sciences Honors Colloquium, University of Oregon, 22 November 2004.

4. "Quantum Feedback Control of Atomic Motion in Cavity QED," Optics Seminar, University of Oregon, 1 November 2004.

3. "Chaos-Assisted Tunneling in Atom Optics," T-8 group seminar, Los Alamos National Laboratory, 7 January 2002.

2. "Chaos-Assisted Tunneling in Atom Optics," Ph.D. Final Defense, The University of Texas at Austin, 5 October 2001.

1. "Quantum Chaos in Atom Optics: A New Generation of Experiments," Ph.D. Qualifying Seminar, The University of Texas at Austin, 14 November 1997.

Conference Publications and Presentations (Contributed)

27. Jonathan Mackrory, Jeremy Thorn, and Daniel Steck, "Quantum Measurements Using Electron-Multiplying Charge-Coupled Devices (EMCCDs)," presented at the 2011 Annual Meeting of the Division of Atomic, Molecular, and Optical Physics (DAMOP) of the American Physical Society, Atlanta, GA, 13–17 June 2011, paper E1.00157. Published in *Bulletin of the American Physical Society* **56**, No. 5, 59 (2011).

26. Jonathan Mackrory, Tanmoy Bhattacharya, and Daniel Steck, "Worldline numerics for electromagnetic Casimir energies," presented at the 2011 Annual Meeting of the Division of Atomic, Molecular, and Optical Physics (DAMOP) of the American Physical Society, Atlanta, GA, 13–17 June 2011, paper E1.00179. Published in *Bulletin of the American Physical Society* **56**, No. 5, 62 (2011).

25. Eryn C. Cook, Paul J. Martin, and Daniel Steck, "Development of a stable, low-cost diode laser system for use in atom optics experiments," presented at the 2011 Annual Meeting of the Division of Atomic, Molecular, and Optical Physics (DAMOP) of the American Physical Society, Atlanta, GA, 13–17 June 2011, paper E1.00107. Published in *Bulletin of the American Physical Society* **56**, No. 5, 51 (2011).

24. Jonathan Mackrory, Kurt Jacobs, and Daniel Steck, "Non-uniform position measurements," presented at the 2010 Annual Meeting of the Division of Atomic, Molecular, and Optical Physics (DAMOP) of the American Physical Society, Houston, TX, 25–29 May 2010, paper E1.00080.

23. Elizabeth Schoene, Jeremy Thorn, and Daniel Steck, "Cooling Atoms with a Moving One-Way Barrier," presented at the 2010 Annual Meeting of the Division of Atomic, Molecular, and Optical Physics (DAMOP) of the American Physical Society, Houston, TX, 25–29 May 2010, paper W5.00005.

22. Jeremy Thorn, Elizabeth Schoene, and Daniel Steck, "Cooling Atoms with a Moving One-Way Barrier," presented at the March 2010 Meeting of the American Physical Society, Portland, OR, 15–19 March 2010, paper Z29.00006. Published in *Bulletin of the American Physical Society* **55**, No. 2 (2010).

21. Elizabeth Schoene, Jeremy Thorn, Tao Li, and Daniel Steck, "Optical One-Way Barrier for Atoms," presented at the the Southwest Quantum Information and Technology Network (SQuInT) Annual Meeting, Seattle, WA, 19–22 February 2009 (poster session).

20. Elizabeth Schoene, Jeremy Thorn, Tao Li, and Daniel Steck, "Optical One-Way Barrier for Atoms," presented at the 2008 Annual Meeting of the Division of Atomic, Molecular, and Optical Physics (DAMOP) of the American Physical Society, State College, PA, 27–31 May 2008, paper L1.00070 (poster session). Published as *Bulletin of the American Physical Society* **53**, No. 7, 98 (2008).

19. Tao Li, Elizabeth Schoene, Jeremy Thorn, and Daniel Steck, "Optical One-Way Barrier for Atoms," presented at the 10th Annual Meeting of the American Physical Society Northwest Section, Portland, Oregon, 15–17 May 2008 (poster session).

18. Daniel A. Steck, "Vibrating Diode Lasers and Zoinks," 2008 Canadian Institute for Advanced Research (CIFAR) Cold Atoms workshop (Bizarre Techniques Bazaar session), Banff, Alberta, Canada, 17–20 April 2008.

17. D. A. Steck, W. H. Oskay, and M. G. Raizen, "Chaos-assisted tunneling in atom optics," presented at the Southwest Quantum Information and Technology Network (SQuInT) Annual Meeting, Boulder, CO, 8–10 March 2002 (poster session).

16. W. H. Oskay, D. A. Steck, and M. G. Raizen, "Chaos-assisted tunneling in atom optics," presented at the 2001 Annual Meeting of the Division of Atomic, Molecular, and Optical Physics (DAMOP) of the American Physical Society, London, Ontario, Canada, 16–19 May 2001, paper J4.004. Published as *Bulletin of the American Physical Society* **46**, No. 3, 55 (2001).

15. W. H. Oskay, D. A. Steck, and M. G. Raizen, "Chaos-assisted tunneling in atom optics," presented at the 2001 Annual Meeting of the Division of Atomic, Molecular, and Optical Physics (DAMOP) of the American Physical Society, London, Ontario, Canada, 16–19 May 2001, paper J4.004. Published as *Bulletin of the American Physical Society* **46**, No. 3, 55 (2001).

14. D. A. Steck, W. H. Oskay, and M. G. Raizen, "Probing mixed phase space dynamics using atom optics," presented at the 2001 Quantum Electronics and Laser Science Conference (QELS), Baltimore, MD, 6–11 May 2001, paper QThI26 (poster session). Published as *Technical Digest; Summaries of Papers Presented at the Quantum Electronics and Laser Science Conference, 2001* (Optical Society of America, Washington, DC, 2001) p. 217.

13. D. A. Steck, V. Milner, W. H. Oskay, and M. G. Raizen, "Recovery of Classically Chaotic Behavior with Noise in the Quantum Kicked Rotor," presented at the 2000 Quantum Electronics and Laser Science Conference (QELS), San Francisco, CA, 7–12 May 2000, paper QThB2. Published as *Technical Digest; Quantum Electronics and Laser Science Conference, 2000* (Optical Society of America, Washington, DC, 2000) p. 165.

12. W. H. Oskay, V. Milner, D. A. Steck, and M. G. Raizen, "Recovering the Classical Limit with Noise in the Quantum Kicked Rotor," presented at the International School of Physics "Enrico Fermi," CXLVI Course, "Recent Advances in Metrology and Fundamental Constants," Varenna, Italy, 25 July – 4 August 2000 (poster session).

11. W. H. Oskay, V. Milner, D. A. Steck, and M. G. Raizen, "Recovering the Classical Limit with Noise in the Quantum Kicked Rotor," presented at the Fall 1999 Meeting of the Texas Section of the American Physical Society, The University of Texas at Austin (Austin, TX), 28–30 October 1999, paper H54.06.

10. M. G. Raizen, B. G. Klappauf, W. H. Oskay, D. A. Steck, and V. Milner, "Experimental Study of Noise and Dissipation Effects on Dynamical Localization," presented at the 1999 Quantum Electronics and Laser Science Conference (QELS), Baltimore, MD, 23–28 May 1999, paper QMA2. Published as *Technical Digest; Summaries of Papers Presented at the Quantum Electronics and Laser Science Conference, 1999* (Optical Society of America, Washington, DC, 1999) p. 4.

9. W. H. Oskay, D. A. Steck, B. G. Klappauf, and M. G. Raizen, "Quantum Signatures of Anomalous Diffusion," presented at the 1999 Quantum Electronics and Laser Science Conference (QELS), Baltimore, MD, 23–28 May 1999, paper QThK3. Published as *Technical Digest; Summaries of papers presented at the Quantum Electronics and Laser Science Conference, 1999* (Optical Society of America, Washington, DC, 1999) p. 240.

8. D. A. Steck, W. H. Oskay, B. G. Klappauf, and M. G. Raizen, "The Role of Accelerator Modes in the Quantum Kicked Rotor," presented at the American Physical Society Centennial Meeting, 20–26 March 1999, paper IB16.04. Published as *Bulletin of the American Physical Society* **44**, No. 1, 412 (1999).

7. W. H. Oskay, B. G. Klappauf, V. Milner, D. A. Steck, and M. G. Raizen, "Experiments on the Role of Noise, Dissipation, and Dimensionality on Dynamical Localization," presented at the American Physical Society Centennial Meeting, 20–26 March 1999, paper RP01.03 (poster session). Published as *Bulletin of the American Physical Society* **44**, No. 1, 1244 (1999).

6. D. A. Steck, W. H. Oskay, B. G. Klappauf, and M. G. Raizen, "Experimental Study of Quantum Chaos with Cesium Atoms," presented at the 1998 Annual Meeting of the Division of Atomic, Molecular, and Optical Physics (DAMOP) of the American Physical Society, Santa Fe, NM, 27–30 May 1998, paper HP.72 (poster session). Published as *Bulletin of the American Physical Society* **43**, 1308 (1998).

5. B. G. Klappauf, W. H. Oskay, D. A. Steck, and M. G. Raizen, "Quantum Signatures of Anomalous Diffusion in Atom Optics," presented at the 1998 International Quantum Electronics Conference (IQEC), Baltimore, MD, 3–8 May 1998, paper QPD9-2 (postdeadline session).

4. B. G. Klappauf, D. A. Steck, W. H. Oskay, and M. G. Raizen, "Experimental Study of Quantum Chaos with Cesium Atoms," presented at the 1998 International Quantum Electronics Conference (IQEC), San Francisco, CA, 3–8 May 1998, paper QThB6. Published as *Technical Digest; Summaries of papers presented at the International Quantum Electronics Conference, 1998* (Optical Society of America, Washington, DC, 1998) p. 159.

3. B. G. Klappauf, D. A. Steck, and M. G. Raizen, "Quantum Chaos in Mixed Phase Space: Beyond the Delta-Kicked Rotor," presented at the 1997 International Quantum Electronics Conference (IQEC), Baltimore, MD, 18–23 May 1997, paper QWD12 (poster session). Published as *Technical Digest; Summaries of papers presented at the International Quantum Electronics Conference, 1997* (Optical Society of America, Washington, DC, 1997) p. 97.

2. D. A. Steck and P. P. Yaney, "Effects of Acoustic Excitation on Temporal Autocorrelation Functions Measured in the Shear Layer of Turbulent Axisymmetric Gas Jets," presented at the 1994 Spring Meeting of the Ohio Section of the American Physical Society, Case Western Reserve University (Cleveland, OH), 13–14 May 1994, paper CD3. Published as *Bulletin of the American Physical Society* **39**, 1299 (1994).

1. P. P. Yaney, J. W. Parish, and D. A. Steck, "Temporal Scale Measurements of Number Density Fluctuations in the Shear Layer of Free and Acoustically Driven Axisymmetric Jets Using a Two Pulsed-Laser Scheme," presented at the 1993 Conference on Lasers and Electro-Optics (CLEO), Baltimore, MD, 2–7 May 1993, paper CtuN69 (poster session). *Technical Digest; Summaries of papers presented at the Conference on Lasers and Electro-Optics, 1993* (Optical Society of America, Washington, DC, 1993) p. 200.

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