Keith C. Schwab

ASSOCIATE PROFESSOR OF PHYSICS

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Education:

- Bachelor of Arts in Physics, University of Chicago, 1990.
- Ph.D. in Physics, University of California, Berkeley, 1996.
  Thesis topic: "Experiments with Superfluid Oscillators"
  Advisor: Prof. Richard Packard.
- Sherman Fairchild Postdoctoral Scholar, California Institute of Technology, 1996-2000.

Employment and Appointments:

- Associate Professor of Physics, Cornell University (starting 17 April 2006).
- Senior Physicist, National Security Agency / Laboratory for Physical Sciences, 2000-April 2006, GS-15 rank.
- Adjunct Professor of Physics, University of Maryland, College Park, 2002-present.
- Visiting Professor at the University of New South Wales, Center for Quantum Computing Technology, January 2002.
- Affiliate member at NASA: Jet Propulsion Laboratory, 1997-2000.
- Sherman Fairchild Postdoctoral Scholar, California Institute of Technology, 1996-2000.

Research Interests:

- Quantum effects in nano-mechanical and nano-electronic systems at ultra-low temperatures.
- Thermal transport and calorimetry at the nanoscale.
- Ultra-sensitive force detection with fully integrated cantilevers / detectors.
- Microdevices to bridge atomic and condensed matter physics experiments.
- Ultra-sensitive microwave measurement techniques.
- Superfluid helium gyroscopes and ultra-sensitive rotation sensors.

Awards and Honors:

- Prize winner at the Young Scholars Competition at the "Amazing Light: Visions for Discovery" International Symposium, in tribute to Nobel Laureate Charles Townes, Berkeley, CA October 6-8, 2005.
- Selected as a member of the first class of the International Atomic Energy Agency's (IAEA) World Nuclear University, 2005 Summer Institute, an intensive program to study many aspects of nuclear technology (power, weapons, proliferation, waste.)

- Selected as a member of "The Forum of Young Global Leaders" which is part of the World Economic Forum (WEF), October 2004. This group meets at the WEF annual meeting in Davos Switzerland for the next 5 years to discuss and propose solutions to diverse problems facing the world today. (www.younggloballeaders.org)
- Named one of the "50 most influential men in America under 38 years old," by *Details Magazine* September 2003.
- Named one of the "10 most innovative in America under 40 years old," by *Fortune Magazine* September 2003.
- Named one of the "world's top 100 innovators in science and technology" by MIT's *Technology and Review* magazine, May 2002.
- Featured in an independent documentary film by Toni Sherwood, "*The Uncertainty Principle: Making of an American Scientist,"* Lucid Films, 2000.
- Michelson Postdoctral Prize Lectureship for 2000, awarded by Case Western-Reserve.
- Awarded the Sherman Fairchild Prize Postdoctoral Fellowship at Caltech, 1996-2000.
- "Best Research Project" at the Fifth Undergraduate Summer Institute on Contemporary Topics in Applied Physics, Lawrence Livermore Laboratories, 1989.
- Eagle Scout, 1986.

Publications:

40. "Quantum Measurement Backaction and Cooling Observed with a Nanomechanical Resonator," A. Naik, O. Buu, M.D. LaHaye, M.P. Blencowe, A.D. Armour, A. A. Clerk, K.C. Schwab, submitted to *Nature* February 2006.

39. "Ion Trap in a Semiconductor Chip," D. Stick, W.K. Hensinger, M.J. Madsen, S. Olmschenk, K. Schwab, C. Monroe, cover article *Nature Physics* 1, (2005.)

38. "Dynamics of a two-level system strongly coupled to a high frequency quantum oscillator," E.K. Irish, J. Gea-Banacloche, I. Martin, and K.C. Schwab, *Phys. Rev. B* **72**, 195410 (2005.)

37. "Nanoscale, phonon-coupled calorimetry with sub-attojoule/Kelvin resolution," W. Fon, K. Schwab, J. M. Worlock, and M.L. Roukes, *Nano Lett*. **5**, 1968 (2005).

36. "Ion trap transducers for quantum electromechanical oscillators," W. K. Hesinger, D. W. Utami, H.-S. Goan, K. C. Schwab, C. Monroe, and G. J. Milburn, *Phys. Rev. A* **72**, 041405(R) (2005.)

35. "Putting *Mechanics* into Quantum Mechanics," K.C. Schwab and M.L. Roukes, cover article *Physics Today 58, 36* (2005.)

34. Comment on *Phys. Rev. Lett.* by Gaidarzhy, et al. "Evidence for quantized displacement in macroscopic nanomechanical oscillator," K. C. Schwab, M.P. Blencowe, M.L. Roukes, A.N. Cleland, S.M. Girvin, G.J. Milburn, K.L. Ekinci, to appear in *Phys. Rev. Lett.* December 2005.

33. "Light-free magnetic resonance force microscopy for studies of electron spin polarized systems," Denis V. Pelekhov, Camelia Selcu, Palash Banerjee, Kin Chung Fong, P. Chris Hammel, Harish Bhaskaran, and Keith Schwab *J. Mag. and Mag. Mat.* **286**, 324 (2005).

32. "Squeezing of a nanomechanical resonator by quantum nondemolition measurement and feedback," Rusko Ruskov, Keith Schwab, and Alexander Korotkov, *Phys. Rev. B*. **71**, 235407 (2005).

31. "Quantum nondemolition squeezing of a nanomechanical resonator," Rusko Ruskov, Keith Schwab, and Alexander N. Korotkov, *IEEE Trans. Nanotech.* **4**, 132-140 (2004.)

30. "Magnetoresistive effects in Planar NiFe Nanoconstrictions," Sylvia Florez, M. Dreyer, K. Schwab, C. Sanchez, and R.D. Gomez, *J. Appl. Phys.* **95**, 6720 (2004.)

29. "Cooling a nanomechanical resonator using feedback: towards quantum behavior," Asa Hopkins, Kurt Jacobs, Salman Habib, Keith Schwab, SPIE **3**, 5276 (2004.)

28. "Approaching the Quantum Limit of a Nanomechanical Resonator," M. LaHaye, O. Buu, B. Camarota, K. Schwab, *Science* 304, 74 (2004).

27. "Dissipation in Nanocrystalline-Diamond Nanomechanical Resonators," A.B. Hutchinson, P. Truitt, L. Sekaric, J. M. Parpia, H. G. Craighead, J. E. Butler, K. C. Schwab, *Appl. Phys. Lett.* **84**, 972 (2004).

26. "Quantum Electro-Mechanical Systems," Keith Schwab, chapter in: *New Directions in Mesoscopics,* edited by R. Fazio, et al. (Kluwer Academic Publisher, Netherlands, 2002.)

25. "Feedback cooling of a nanomechanical resonators," Asa Hopkins, Salmin Habib, K. Schwab, *Phys. Rev. B* **68,** 235328, (2004.)

24. "Quantum Measurement of a Coupled Nanomechanical Resonator—Cooper Pair Box System," Elinor K. Irish and K. Schwab, *Phys. Rev. B* **68**, *155311* (2003.)

23. "Spring constant and damping constant tuning of nanomechanical resonators using a single-electron transistor," K. Schwab, *Appl. Phys. Lett.* **80**, 1276 (2002.)

22. "Quantum Dynamics of a Cooper-Pair Box Coupled to a Micromechanical Resonator," A.D. Armour, M.P. Blencowe, and K. Schwab, *Phys. Rev. Lett.* **88**, 148301 (2002.)

21. "Mechanical Lamb-shift analogue for the Cooper-pair box," A.D. Armour, M.P. Blencowe, and K.C. Schwab, *Physica B **316**,* 406 (2002.)

20. "Phonon scattering mechanism in suspended nanostructure from 4 to 40K," W Fon**,** K Schwab, J.M. Worlock, and M.L. Roukes, *Phys. Rev. B* **66**, 045302 (2002.)

19. "Measurement of the Quantum of Thermal Conductance," K. Schwab, E.A. Henriksen, J.M. Worlock, and M.L. Roukes, *Nature* 404, 974-977 (2000.)

18. "Quantum Measurement with Nanomechanical Systems," in the proceedings of the International Conference on Solid State Implementations of Quantum Computing, Sydney, Australia, January 2001.

17. "Thermal conductance through discrete quantum channels," K. Schwab, W. Fon, E.A. Henriksen, J.M. Worlock, M.L. Roukes, *Physica E* **9**, 60-68 (2001.)

16. "Quantized thermal conductance: measurements in nanostructures," K. Schwab, W. Fon, E. Henriksen, J.M. Worlock, M.L. Roukes, *Physica B* **280 (1-4)**, 458-459 (2000.)

15. "Detection of the Earth's Rotation Using Superfluid Phase Coherence," K. Schwab, N. Bruckner, and R. E. Packard", *Nature* 386, pp. 585-587 (1997.)

14. "Detection of Absolute Rotation using Superfluid ^{4}He," K. Schwab, N. Bruckner, and R.E. Packard, *Low Temp. Phys.* **24** (24), February 1998.

13. "The Superfluid 4He Analog of the *rf* SQUID," K. Schwab, N. Bruckner, and R.E. Packard, *JLTP* **110** (5-6), pp. 1043-1104 (1998).

12. "Thermoviscous Effects in Steady and Oscillating Flow of Superfluid ^{4}He: Experiments," S. Backhaus, K. Schwab, A. Loshak, S. Perevezev, N. Bruckner, J.C. Davis, and R.E. Packard, *JLTP* **109** (3-4), pp. 527-546 (1997).

11. "Phase-slip memory effects in dissipation-free superflow", K. Schwab, J. Stienhauer, and Richard Packard, *Phys. Rev. B* **55**, pp. 8094-8097 (1997).

10. "Fabrication of a Silicon-based Superfluid Oscillator," K. Schwab, J. Steinhauer, J.C. Davis, and R.E. Packard, *J. Microelectromech. Syst.* **5**, pp. 180-186 (1996).

9. "A Microfabricated Superfluid *rf* SQUID," K. Schwab, J.C. Davis, and R.E. Packard, *Czech. J. Phys.* **46**, pp. 2739-2740 (1996).

8. "Study of an array of superfluid ^{3}He weak links," Yu. Mukharsky, A. Loshak, K. Schwab, J.C. Davis, and R.E. Packard, *Czech. J. Phys.* **46**, pp. 115-116 (1996).

7. "The intrinsic critical velocity near T_λ," Scott Backhaus, Niels Bruckner, Alex Loshak, Keith Schwab, and Richard Packard, *Czech. J. Phys.* **46**, pp. 127-128 (1996).

6. "Vortex Nucleation in Superfluid 4He," J. Stienhauer, K. Schwab, Yu. Mukharsky, J.C. Davis, and R.E. Packard, *Phys. Rev. Lett.* **74**, July (1995).

5. "The Determination of the Energy Barrier for Phase Slips in Superfluid ^{4}He", J. Steinhauer, K. Schwab, Yury Mukharsky, J.C. Davis, and R.E. Packard, *JLTP* **100**, pp. 281-307 (1995).

4. "Effects of ^{3}He Impurities on the Nucleation of Phase Slips in Superfluid ^{4}He," Y.M. Mukharsky, K. Schwab, J. Steinhauer, A. Amar, Y. Sasaki, J.C. Davis, and R.E. Packard, *Physica B* **194-196**, pp. 591-2 (1994).

3. "The Characteristic Response Curve, I(ΔP), of a ^{3}He Weak Link," J. Steinhauer, K. Schwab, Y.M. Mukharsky, J.C. Davis, and R.E. Packard, *Physica B* **194-196**, pp. 767-8 (1994).

2. "Evidence for Quantum Tunneling of Phase Slip Vortices," J.C. Davis, J. Steinhauer, K. Schwab, Yu. Mukharsky, A. Amar, Y. Sasaki, and R.E. Packard, *Phys. Rev. Lett.* **69**, pp. 323-6 (1992).

1. "Faceted Crystal Growth in Two Dimensions," B. Berge, L. Faucheux, K. Schwab, A. Libchaber, *Nature* 350, p. 320 (1991).

Invited Talks

International Conferences and Workshops

45. "Cooper-Pair Molasses: Cooling a Nanomechanical Resonator with Quantum Backaction," annual meeting of the DPG / European Physical Society, Dresden, Germany, March 2006

44. "Cooper-Pair Molasses: Cooling a Nanomechanical Resonator with Quantum Backaction," *Cold Atoms Meet Condensed Matter*, Dresden, Germany, March 2006.

43. "Cooling a Nanomechanical Resonator with Quantum Backaction," *Quantum Nanoscience*, Noosa Heads, Australia, January 2006.

42. "Mechanics at the Quantum Limit," *Nanodays Workshop,* University of Jyvaskyla, Finland October 2005.

41. "Quantum effects in small mechanical devices," *Amazing Light Symposium in honor of Charles Townes, Young Scholars Competition,* Berkeley, CA 2005.

40. "Cooling of a Nanomechanical Resonator Using Quantum Noise of an SET," *QUEST: Quantum Enabled Science and Technology*, Los Alamos National Laboratory, August 2005.

39. "Cooling of a Nanomechanical Resonator Using Quantum Noise of an SET," *Workshop on Quantum Feedback and Quantum Control,* Caltech, August 2005.

38. "Mechanics at the Quantum Limit," *Physics and Chemistry Timberline Retreat,* University of Oregon, September 2004.

37. "Progress in Quantum Electro-Mechanics," *The Second-Annual Feynman Festival,* University of Maryland, College Park, August 2004.

36. "Feedback cooling of a nanomechanical resonator," *Workshop on Quantum Feedback and Quantum Control,* Caltech, August 2004.

35. "Feedback cooling of a nanomechanical resonator," *QUEST: Quantum Enabled Science and Technology*, Los Alamos National Laboratory, August 2004.

34. "Quantum Limit of Nanomechanics," *Gordon Research Conference on Nanostructure Fabrication*, Tilton, New Hampshire, July 2004.

33. "Approaching the Quantum Limit of a Mechanical System," invited talk, *Frontier of Quantum and Mesoscopic Thermodynamics,"* satellite meeting of the European Physical Society, Prague, Czech Republic, July 2004.

32. "Approach to the Uncertainty Principle" and "Coupling Mechanics to Qubits," Nanomechanics summer school-PASI, San Carlos de Bariloche, Argentina, July 2004.

31. "Experimental Progress in Quantum Electro-Mechanics," invited talk, *Workshop on Nanoelectromechanical Systems*, held by the Nobel Institute of Physics, Royal Swedish Academy of Sciences, June 2004.

30. "Analogies between Cavity QED and Quantum Electro-Mechanics," invited talk, *Mesoscopic physics, quantum optics, and quantum information,* held at the Harvard Institute for Theoretical Atomic, Molecular, and Optical Physics, May 2004.

29. "Approaching Quantum Limits of Position Detection," invited talk, American Physical Society, March 2004.

28. "Approaching Quantum Limits of Position Detection," invited talk at the Center for Quantum Computing Technology Annual Review, Sydney, Australia, February 2004.

27. "Quantum Electro-Mechanics," *Southwest Quantum Information Network (SQUINT)*, held at UC San Diego, February 2004.

26. "Progress in Quantum Electro-Mechanics," *QUEST: Quantum Enabled Science and Technology*, Los Alamos National Laboratory, August 2003.

25. "Quantum Limits of Nanomechanics," Department of Energy workshop on the future of nanomechanics, Asilomar CA, April 2003.

24. "Can we control the quantum state of a nano-mechanical resonator," *Quantum Control Workshop* held at MIT, October 2002.

23. "Quantum Electro-Mechanics: Experimental Prospects," *QUEST: Quantum Enabled Science and Technology*, Los Alamos National Laboratory, August 2002.

22. "Quantum Electro-Mechanics: Experimental Prospects," *New Directions in Mesoscopics*, NATO ASI, Erice, Italy, July 2002.

21. "Quantum Electro-Mechanics: Experimental Prospects," *Nanoscale and Molecular Mechanics*, Maui, Hawaii, May 2002. Invited speaker for both the school and the conference sessions.

20. "Quantum Measurement in Nanomechanics," invited speaker at the *Quantum Information and Computing Summer School*, University of Queensland, Queensland, Australia, February 2002.

19. "Mesoscopic Energy Transport," Plenary lecture at *Phonons 2001*, Dartmouth University, August 2001.

18. "Quantum Electro-Mechanics: A Mechanical Analog of Cavity QED," *QUEST:Quantum Enabled Science and Technology*, Los Alamos National Laboratory, August 2001.

17. "Thermal Conductance and Heat Capacity at the Quantum Limit," Invited presentation at the *9th International Workshop on Low Temperature Detectors*, Madison, Wisconsin, July 2001.

16. "Quantum measurement in Nanomechanical Systems," *Quantum-Electro-Mechanics Pow-Wow*, which was a small workshop that I have organized. Caltech, April 2001.

15. "Mesoscopic Energy Transport," Invited presentation at the *American Physical Society March Meeting* symposium "Heat flow in the Quantum Limit," Seattle 2001.

14. "Quantum measurement with Nanomechanical Systems," invited speaker at *the International Conference on Experimental Implementation of Quantum Computation*, January 2001, Sydney, Australia.

13. "Mesoscopic Energy Transport," National *Conference on Condensed Matter and Materials Physics Bristol*, England, December 2000.

12. "Quantum Measurement and Computation at the Laboratory for Physical Sciences," invited presentation at the National Academy of Sciences and Engineering meeting, Irvine, California, November, 2000.

11. "Mesoscopic Energy Transport," NATO workshop: *Decoherence and its Implications in Quantum Computation and Information Transfer*, Mykonos, Greece, July 2000.

Michelson Postdoctral Prize Lectures given at Case Western Reserve in May 2000, each 1 hour:

10. "*SQUIDs and SETs: Introduction to Quantum Limited Amplifiers and their Applications*"

9. "The Josephson Effect in Superfluids"

8. "Nanofabrication for Fundamental Physics"

7. "Measurement of the Quantum of Thermal Conductance"

6. "Measurement of the Quantum of Thermal Conductance," *Mesoscopic Physics Workshop*, Oslo, Norway, December 1999.

5. "Measurement of the Quantum of Thermal Conductance," *11th International Winterschool on New Developments in Solid State Physics*, Mauterndorf Austria, Feb. 2000.

4. "Nanofabrication at Caltech," *US-Swiss Nanoforum*, Zurich, Switzerland, September 1999.

3. "Quantized Thermal Conductance: Measurements in Nanostructures," *International Conference on Low Temperature Physics*, Helsinki, Finland, August 1999.

2. "Yactocalorimetry: Phonon Thermal Transport and Calorimetry at the Quantum Limit," American Physical Society, March 1998

1. "A Microfabricated Superfluid ^{4}He *rf* SQUID, *International Conference on Low Temperature Physics*, Prague, Czech Republic, 10 August 1996.

Colloquia and Seminars

65. "Pursuit of quantum mechanics in a mechanical device," colloquium at the Department of Physics, University of Oregon, Eugene, March 2006.

64. "Pursuit of quantum mechanics in a mechanical device," colloquium at the Department of Physics, University of Melbourne, February 2006.

63. "Pursuit of quantum mechanics in a mechanical device," colloquium at the Department of Physics, Helsinki University of Technology, October 2005.

62. "Pursuit of quantum mechanics in a mechanical device," colloquium at the Department of Physics, University of Maryland, Baltimore County, September 2005.

61. "Pursuit of quantum mechanics in a mechanical device," seminar at the Department of Physics, McGill University, March 2005.

60. "Entanglement in mechanical systems," seminar at the Department of Physics, Cornell University, February 2005.

59. "Entanglement in mechanical systems," seminar at the Department of Physics, University of Illinois, Urbana-Champaign, February 2005.

58. "Pursuit of quantum mechanics in a mechanical device," seminar at the Department of Physics, Purdue University, February 2005.

57. "Pursuit of quantum mechanics in a mechanical device," seminar at the Department of Physics, University of Wisconsin, February 2005.

56. "Entanglement in mechanical systems," seminar at the Department of Physics, University of Vienna, January 2005.

55. "Entanglement in mechanical systems," colloquium in the Department of Physics, ETH Zurich, January 2005.

54. "Putting the *mechanics* back into quantum mechanics," colloquium at Department of Physics, University of California, Berkeley, December 2004.

53. "Putting the *mechanics* back into quantum mechanics," colloquium at Department of Physics, University of Delaware, November 2004.

52. "Putting the *mechanics* back into quantum mechanics," colloquium at Department of Physics, Ohio State University, Columbus, November 2004.

51. "Putting the *mechanics* back into quantum mechanics," colloquium at Department of Physics, Case Western Reserve University, Cleveland, October 2004.

50. "Progress in Quantum Electro-Mechanical experiments," *Quantum Information and Computation Seminar*, University of Maryland, College Park, October 2004.

49. "Progress in Quantum Electro-Mechanical experiments," Condensed matter physics seminar series, Department of Physics, Cornell University, September 2004.

48. "Progress in Experimental Quantum Electro-Mechanics," seminar and the *Quantum Lunch Series*, Los Alamos National Laboratory, July 2004.

47. "Progress in Experimental Quantum Electro-Mechanics," seminar at the Department of Physics, Delft University, June 2004.

46. "Progress in Experimental Quantum Electro-Mechanics," seminar at the Department of Physics, London Imperial College, June 2004.

45. "Progress in Experimental Quantum Electro-Mechanics," colloquium at the University of California, San Diego, May 2004.

44. "Progress in Experimental Quantum Electro-Mechanics," seminar at the University of California, Berkeley, May 2004.

43. "Progress in Experimental Quantum Electro-Mechanics," colloquium at Yale University, May 2004.

42. "Quantum Electro-Mechanics: a Cavity QED analog," colloquium in the Department of Physics, Caltech, April 2004.

41. "Approach to the Uncertainty Principle in Nanomechanics," seminar in the Department of Mechanical Engineering, Columbia University, March 2004.

40. "Approach to the Uncertainty Principle in Nanomechanics," seminar at the Jet Propulsion Laboratory, Pasadena, February, 2004.

39. "Mechanical Systems at the Quantum Limit," seminar in the Department of Physics, Massachusetts Institute of Technology, January 2004.

38. "Mechanical Systems at the Quantum Limit," colloquium in the Department of Physics, Pennsylvania State University, January 2004.

37. "Progress in Quantum Electro-mechanics," seminar at the National Institute of Standards and Technology, Atomic Physics Group, January 2004.

36. "Approaching the Uncertainty Principle in Nanomechanics," condensed matter physics seminar, Princeton University, November 2003.

35. "Approaching the Uncertainty Principle in Nanomechanics," *Quantum Information and Computation Seminar*, University of Maryland, College Park, November 2003.

34. "Quantum Limited Measurement of Position," Nanomechanics seminar, Department of Physics, Cornell University, October 2003.

33. "Approaching the Uncertainty Principle," colloquium in the Department of Physics, University of Buffalo, October 2003.

32. "Approaching the Uncertainty Principle," colloquium in the Department of Material Science, Rensselaer Polytechnic Institute, September 2003.

31. "Putting the *mechanics* back into Quantum Mechanics," condensed matter seminar in the Department of Physics, Ohio State, May 2003.

30. "Putting the *mechanics* back into Quantum Mechanics," colloquium in the Department of Physics, University of Georgia, Athens, May 2003.

29. "Putting the *mechanics* back into Quantum Mechanics," colloquium in the Department of Physics, University of Rochester, NY, April 2003.

28. "Putting the *mechanics* back into Quantum Mechanics," colloquium in the Department of Physics, McMaster University, Hamilton, Canada, November 2002.

27. "Quantum Electro-Mechanics: Experimental Prospects," condensed matter seminar, Naval Research Laboratory, June 2002.

26. “Mesoscopic Energy Transport,” Center for Superconductivity, University of Maryland College Park, June 2002.

25. “Putting the *mechanics* back into Quantum Mechanics,” colloquium in the Department of Physics, University of Illinois, Urbana-Champaign, March 2002.

24. “Putting the *mechanics* back into Quantum Mechanics,” seminar at the Center for the Solid State Quantum Computer, University of New South Wales, Australia, February 2002.

23. “Nanomechanics and Single-Electronics,” colloquium, Sandia National Laboratory, December, 2001.

22. “Nanomechanics and Single-Electronics,” colloquium, in the Department of Physics, University of Kansas, November, 2001.

21. “Mechanical systems at the Quantum Limit,” colloquium in the Department of Physics, George Mason University, April 2001.

20. “Mesoscopic Energy Transport,” condensed matter seminar, Australian National University, Canberra, January 2001.

19. “Measurement of the Quantum of Thermal Conductance,” colloquium in the Department of Physics, University of Maryland, College Park, MD, Nov. 2000.

18. “Measurement of the Quantum of Thermal Conductance,” condensed matter seminar, Dartmouth University, November 2000.

17. “Measurement of the Quantum of Thermal Conductance,” condensed matter seminar, University of Pennsylvania, October 2000.

16. “Measurement of the Quantum of Thermal Conductance,” colloquium in the Department of Physics, University of Trento, Italy, July 2000.

15. “Measurement of the Quantum of Thermal Conductance,” colloquium in the Department of Physics, University of Colorado at Boulder, May 2000.

14. “Measurement of the Quantum of Thermal Conductance,” colloquium in the Department of Physics, Ohio State University, Columbus, Ohio, May 2000.

13. “Measurement of the Quantum of Thermal Conductance,” colloquium in the Department of Physics, Georgetown University, Washington D.C., April 2000.

12. “Measurement of the Quantum of Thermal Conductance,” condensed matter seminar, National Institute of Standards and Technology, Gaithersburg, MD, April 2000.

11. “Measurement of the Quantum of Thermal Conductance,” condensed matter seminar, Los Alamos National Laboratory, January 2000.

10. “Measurement of the Quantum of Thermal Conductance,” colloquium in the Department of Physics, University of Utah, Salt Lake City, January 2000.

9. “Measurement of the Quantum of Thermal Conductance,” Laboratory for Physical Sciences, College Park, MD, January 2000.

8. “Measurement of the Quantum of Thermal Conductance,” Solid State Seminar at Caltech, Pasadena CA, November 1999.

7. “Measurement of the Quantum of Thermal Conductance,” University of California, Los Angeles, November 1999.

6. “Yactocalorimetry: Phonon Thermal Transport and Calorimetry at the Quantum Limit,” Physics Department Colloquium, Purdue University, February 1998.

5. “Superfluid Quantum Gyroscope: Detection of the Earth’s Rotation using a Superfluid SQUID,” colloquium in the Department of Physics, University of Utah, Salt Lake City, December 1997.

4. “Superfluid Quantum Gyroscope: Detection of the Earth’s Rotation using a Superfluid SQUID,” Condensed Matter Seminar, condensed matter seminar, California Institute of Technology, May 1997.

3. “Progress Toward a Quantum Gyroscope: the Superfluid Analog of the *rf* SQUID,” Jet Propulsion Laboratory-NASA, Pasadena, CA, January 1996.

2. “Quantized Dissipation in Superfluid ^{4}He: Results from Recent Experiments,” colloquium in the Department of Physics, University of Trento, Italy, July 1995.

1. “Nucleation of Quantized Phase Slips and the Critical Velocity Problem in ^{4}He,” condensed matter seminar, Physics Department, University of California, Berkeley, November 1994.

Teaching Lectures

“Understanding Noise in Measurements,” 3 one hour seminars taught at Ohio State, Department of Physics, May 2003.

“Quantum Transport in Nanostructures,” taught at:

University of Maryland, College Park, May 2003

Boston University, April 2003

University of Maryland, College Park, May 2002