

# Konrad W. Lehnert

JILA, University of Colorado  
440 UCB  
Boulder, CO 80309-0440  
USA

Phone: 303-492-8348  
Fax: 303-492-5235  
Email: [konrad.lehnert@jila.colorado.edu](mailto:konrad.lehnert@jila.colorado.edu)  
Web: <http://jila.colorado.edu/lehnert>  
ResearcherID: B-7577-2009  
ORCID: 0000-0002-0750-9649

## Education

**University of California at Santa Barbara**, Santa Barbara, California  
Ph.D., Physics, June 1999

Dissertation:

Nonequilibrium Dynamics in Mesoscopic Superconductor-Semiconductor-Superconductor Junctions  
Advisor: Prof. S. James Allen

**Harvey Mudd College**, Claremont, California  
B.S., Physics, with honors, May 1993

## Appointments

**JILA, National Institute of Standards and Technology and University of Colorado**, Boulder, Colorado

*Professor of Physics (adjoint)*, January 2014- present

*Associate Professor of Physics (adjoint)*, January 2009- January 2014

*JILA Fellow*, September 2007- present

*Assistant Professor of Physics (adjoint)*, February 2003 – December 2008

*Associate Fellow of JILA*, January 2003 – September 2007

*Physicist*, NIST, January 2003 – present

**Yale Applied Physics Department**, New Haven, Connecticut

*Associate Research Scientist*, December 2001 – December 2002

*Post-doctoral Associate*, August 1999 – December 2001

Advisor: Prof. Robert J. Schoelkopf

**University of California at Santa Barbara**, Santa Barbara, California

*Graduate Student Researcher*, 1995 – 1999

*Teaching Assistant*, 1994 – 1995

**Pacific Communication Sciences Inc.**, San Diego, California

*Member of Technical Staff (analog/ rf designer)*, 1993 – 1994

## Awards and Honors

Vannevar Bush Faculty Fellowship, 2020  
Department of Commerce, Silver Medal (with John Teufel, Ray Simmonds, and Joe Aumentado) 2019  
Governor's award for high impact research (with Cindy Regal), 2016  
Fellow of the American Physical Society, 2013  
Kavli Fellow, 2011  
Kavli Fellow, 2010  
Service to America award finalist, 2007

## Publications (refereed articles and edited book chapters)

73 “Hybrid quantum systems with circuit quantum electrodynamics,” A.A. Clerk, **K.W. Lehnert**, P. Bertet, J.R. Petta, Y. Nakamura, *Nature Physics* **16**, 257–267 (2020).

72 “Measurement of Motion beyond the Quantum Limit by Transient Amplification,” R. D. Delaney, A. P. Reed, R. W. Andrews, and K. W. Lehnert *Phys. Rev. Lett.* **123**, 183603 (2019).

71 “Resolving Phonon Fock States in a Multimode Cavity with a Double-Slit Qubit,” L.R. Sletten, B.A. Moores, J.J. Viennot, **K.W. Lehnert**, *Phys. Rev. X* **9**, 021056 (2019).

70 “Putting the squeeze on axions,” K. van Bibber, **K. Lehnert**, A. Chou, *Physics Today* **72**, 48 (2019).

69 “Squeezed Vacuum Used to Accelerate the Search for a Weak Classical Signal,” M. Malnou, D.A. Palken, B.M. Brubaker, L.R. Vale, G.C. Hilton, **K.W. Lehnert**, *Phys. Rev. X* **9**, 021023 (2019).

68 “Design of an On-Chip Superconducting Microwave Circulator with Octave Bandwidth,” B.J. Chapman, E.I. Rosenthal, **K.W. Lehnert**, *Phys. Rev. Applied* **11**, 044048 (2019).

67 “Results from phase 1 of the HAYSTAC microwave cavity axion experiment,” L. Zhong, A. Kenany, K.M. Backes, B.M. Brubaker, S.B. Cahn, G. Carosi, Y.V. Gurevich, W.F. Kindel, S.K. Lamoreaux, **K.W. Lehnert**, S.M. Lewis, M. Malnou, R.H. Maruyama, D.A. Palken, N.M. Rapidis, J.R. Root, M. Simanovskaia, T.M. Shokair, D.H. Speller, I. Urdinaran, K.A. van Bibber, *Phys. Rev. D* **97**, 092001 (2018).

66 “Phonon-Number-Sensitive Electromechanics,” J.J. Viennot, X. Ma, **K.W. Lehnert**, *Phys. Rev. Lett.* **121**, 183601 (2018).

65 “Harnessing electro-optic correlations in an efficient mechanical converter,” A.P. Higginbotham, P.S. Burns, M.D. Urmev, R.W. Peterson, N.S. Kampel, B.M. Brubaker, G. Smith, **K.W. Lehnert**, C.A. Regal, *Nature Physics*, **14**, 1038–1042 (2018).

- 64 “Topological phase transition measured in a dissipative metamaterial,” E.I. Rosenthal, N.K. Ehrlich, M.S. Rudner, A.P. Higginbotham, **K.W. Lehnert**, *Phys. Rev. B* **97**, 220301 (2018).
- 63 “Cavity Quantum Acoustic Device in the Multimode Strong Coupling Regime,” B.A. Moores, L.R. Sletten, J.J. Viennot, **K.W. Lehnert**, *Phys. Rev. Lett.* **120**, 227701 (2018).
- 62 “Optimal Operation of a Josephson Parametric Amplifier for Vacuum Squeezing” M. Malnou, D.A. Palken, L.R. Vale, G.C. Hilton, **K.W. Lehnert**, *Phys. Rev. Applied* **9**, 044023 (2018).
- 61 “HAYSTAC axion search analysis procedure” B. M. Brubaker, L. Zhong, S. K. Lamoreaux, **K. W. Lehnert**, and K. A. van Bibber, *Phys. Rev. D* **96**, 123008 (2017).
- 60 “Widely Tunable On-Chip Microwave Circulator for Superconducting Quantum Circuits” B.J. Chapman, E.I. Rosenthal, J. Kerckhoff, B.A. Moores, L.R. Vale, J.A.B. Mates, G.C. Hilton, K. Lalumière, A. Blais, **K.W. Lehnert**, *Phys. Rev. X* **7**, 041043 (2017).
- 59 “Breaking Lorentz Reciprocity with Frequency Conversion and Delay” E.I. Rosenthal, B.J. Chapman, A.P. Higginbotham, J. Kerckhoff, **K.W. Lehnert**, *Phys. Rev. Lett.* **119**, 147703 (2017).
- 58 “Faithful conversion of propagating quantum information to mechanical motion,” A.P. Reed, K.H. Mayer, J.D. Teufel, L.D. Burkhardt, W. Pfaff, M. Reagor, L. Sletten, X. Ma, R.J. Schoelkopf, E. Knill, **K.W. Lehnert**, *Nature Phys.*, **13**, 1163–1167 (2017).
- 57 “Reconfigurable re-entrant cavity for wireless coupling to an electro-optomechanical device,” T. Menke, P.S. Burns, A.P. Higginbotham, N.S. Kampel, R.W. Peterson, K. Cicak, R.W. Simmonds, C.A. Regal, **K.W. Lehnert**, *Review of Scientific Instruments* **88**, 094701 (2017).
- 56 “Single-sideband modulator for frequency domain multiplexing of superconducting qubit readout,” B.J. Chapman, E.I. Rosenthal, J. Kerckhoff, L.R. Vale, G.C. Hilton, **K.W. Lehnert**, *Appl. Phys. Lett.* **110**, 162601 (2017).
- 55 “Improving Broadband Displacement Detection with Quantum Correlations,” N.S. Kampel, R.W. Peterson, R. Fischer, P.L. Yu, K. Cicak, R.W. Simmonds, **K.W. Lehnert**, C.A. Regal, *Phys. Rev. X* **7**, 021008 (2017).
- 54 “Design and operational experience of a microwave cavity axion detector for the 20 - 100 micro-eV range,” A. Kenany, M.A. Anil, K.M. Backes, B.M. Brubaker, S.B. Cahn, G. Carosi, Y.V. Gurevich, W.F. Kindel, S.K. Lamoreaux, **K.W. Lehnert**, S.M. Lewis, M. Malnou, D.A. Palken, N.M. Rapidis, J.R. Root, M. Simanovskaia, T.M. Shokair, I. Urdinaran, K.A. van Bibber, L. Zhong, *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* **854**, 11 - 24 (2017).
- 53 “First Results from a Microwave Cavity Axion Search at  $24 \square$  eV,”

B.M. Brubaker, L. Zhong, Y.V. Gurevich, S.B. Cahn, S.K. Lamoreaux, M. Simanovskaia, J.R. Root, S.M. Lewis, A. Kenany, K.M. Backes, I. Urdinaran, N.M. Rapidis, T.M. Shokair, K.A. van Bibber, D.A. Palken, M. Malnou, W.F. Kindel, M.A. Anil, **K. W. Lehnert**, G. Carosi, *Phys. Rev. Lett.* **118**, 061302 (2017).

52 “General purpose multiplexing device for cryogenic microwave systems,” B.J. Chapman, B.A. Moores, E.I. Rosenthal, J. Kerckhoff, **K.W. Lehnert**, *Appl. Phys. Lett.* **108**, (2016).

51 “Generation and efficient measurement of single photons from fixed-frequency superconducting qubits,” W. F. Kindel, M. D. Schroer, **K. W. Lehnert**, *Phys. Rev. A* **93**, 033817 (2016).

50 “Proposal to Test Bell's Inequality in Electromechanics,” S. G. Hofer, **K. W. Lehnert**, K. Hammerer, *Phys. Rev. Lett.* **116**, 070406 (2016).

49 “Laser Cooling of a Micromechanical Membrane to the Quantum Backaction Limit,” R. W. Peterson, T. P. Purdy, N. S. Kampel, R. W. Andrews, P. L. Yu, **K. W. Lehnert**, C. A. Regal, *Phys. Rev. Lett.* **116**, 063601 (2016).

48 “Closing a quantum feedback loop inside a cryostat: Autonomous state preparation and long-time memory of a superconducting qubit,” Christian Kraglund Andersen, Joseph Kerckhoff, **Konrad W. Lehnert**, Benjamin J. Chapman, and Klaus Mølmer, *Phys. Rev. A* **93**, 012346 (2016).

47 “Quantum-enabled temporal and spectral mode conversion of microwave signals,” R. W. Andrews, A. P. Reed, K. Cicak, J. D. Teufel, **K. W. Lehnert**, *Nature Comm.*, **6**, 10021 (2015).

46 “On-Chip Superconducting Microwave Circulator from Synthetic Rotation,” J. Kerckhoff, K. Lalumière, B. J. Chapman, A. Blais, **K. W. Lehnert**, *Phys. Rev. Applied*, **4**, 034002 (2015).

45 “Generating and verifying entangled itinerant microwave fields with efficient and independent measurements,” H.-S. Ku, W. F. Kindel, F. Mallet, S. Glancy, K. D. Irwin, G. C. Hilton, L. R. Vale, **K. W. Lehnert**, *Phys. Rev. A*, **91**, 042305 (2015).

44 “Measuring a Topological Transition in an Artificial Spin-1/2 System,” M. D. Schroer, M. H. Kolodrubetz, W. F. Kindel, M. Sandberg, J. Gao, M. R. Vissers, D. P. Pappas, Anatoli Polkovnikov, and **K. W. Lehnert**, *Physical Review Letters*, **113**, 050402 (2014).

43 “Future directions in the microwave cavity search for dark matter axions,” T. M. Shokair, J. Root, K. A. van Bibber, B. Brubaker, Y. V. Gurevich, S. B. Cahn, S. K. Lamoreaux, M. A. Anil, **K. W. Lehnert**, B. K. Mitchell, A. Reed, G. Carosi, *International Journal of Modern Physics A* **29**, 1443004 (2014).

- 42 “Bidirectional and efficient conversion between microwave and optical light,” R. W. Andrews, R. W. Peterson, T. P. Purdy, K. Cicak, R. W. Simmonds, C. A. Regal and **K. W. Lehnert**, *Nature Physics*, **10**, 321–326 (2014).
- 41 “Entangling Mechanical Motion with Microwave Fields,” T. A. Palomaki, J. D. Teufel, R. W. Simmonds, **K. W. Lehnert**, *Science*, **342**, 710 – 713 (2013).
- 40 “Deterministic entanglement of superconducting qubits by parity measurement and feedback,” D. Ristè, M. Dukalski, C. A. Watson, G. de Lange, M. J. Tiggelman, Ya. M. Blanter, **K. W. Lehnert**, R. N. Schouten, and L. DiCarlo, *Nature*, **502**, 350–354 (2013).
- 39 “Analysis of single-photon and linear amplifier detectors for microwave cavity dark matter axion searches,” S. K. Lamoreaux, K. A. van Bibber, **K. W. Lehnert**, G. Carosi, *Phys. Rev. D*, **88**, 035020 (2013).
- 38 “Tunable Coupling to a Mechanical Oscillator Circuit Using a Coherent Feedback Network,” Joseph Kerckhoff, Reed W. Andrews, H. S. Ku, William F. Kindel, Katarina Cicak, Raymond W. Simmonds, and **K. W. Lehnert**, *Phys. Rev. X*, **3**, 021013 (2013).
- 37 “Millisecond charge-parity fluctuations and induced decoherence in a superconducting transmon qubit,” D. Ristè, C. C. Bultink, M. J. Tiggelman, R. N. Schouten, **K. W. Lehnert**, and L. DiCarlo, *Nature Comm.*, **4**, 1913 (2013).
- 36 “Mechanical resonators for storage and transfer of electrical and optical quantum states,” S. A. McGee, D. Meiser, C. A. Regal, **K. W. Lehnert**, and M. J. Holland, *Phys. Rev. A*, **87**, 053818 (2013).
- 35 “Coherent state transfer between itinerant microwave fields and a mechanical oscillator,” T. A. Palomaki, J. W. Harlow, J. D. Teufel, R. W. Simmonds, and **K. W. Lehnert**, *Nature*, **495**, 210–214, (2013).
- 34 “Feedback Control of a Solid-State Qubit Using High-Fidelity Projective Measurement,” D. Riste, C. C. Bultink, **K. W. Lehnert**, and L. DiCarlo, *Phys. Rev. Lett.*, **109**, 240502 (2012).
- 33 “A superconducting microwave multivibrator produced by coherent feedback,” Joseph Kerckhoff and **K. W. Lehnert**, *Phys. Rev. Lett.*, **109**, 153602 (2012).
- 32 “Initialization by Measurement of a Superconducting Quantum Bit Circuit,” D. Ristè, J. G. van Leeuwen, H.-S. Ku, **K. W. Lehnert**, and L. DiCarlo, *Phys. Rev. Lett.*, **109**, 050507 (2012).
- 31 “Flux-Ramp Modulation for SQUID Multiplexing,” J. A. B. Mates, K. D. Irwin, L. R. Vale, G. C. Hilton, J. Gao and **K. W. Lehnert**, *Journal of Low Temperature Physics*, available online: <http://dx.doi.org/10.1007/s10909-012-0518-6> (2012).

- 30 “Micromechanics and Superconducting Circuits,” **K. W. Lehnert**, in Les Houches Lectures on Quantum Machines, M. Devoret, B. Huard, Eds., Oxford University Press (2014).
- 29 “Introduction to Microwave Cavity Optomechanics,” **K. W. Lehnert**, in Cavity Optomechanics, M. Aspelmeyer, T. Kippenberg, F. Marquardt, Eds., Springer, (2014).
- 28 “Non-contact and all-electrical method for monitoring the motion of semiconducting nanowires,” S. W. Hoch, J. R. Montague, V. M. Bright, C. T. Rogers, K. A. Bertness, J. D. Teufel, and **K. W. Lehnert**, *Appl. Phys. Lett.* **99**, 053101 (2011).
- 27 “Sideband Cooling Micromechanical Motion to the Quantum Ground State,” J. D. Teufel, T. Donner, Dale Li, J. W. Harlow, M. S. Allman, K. Cicak, A. J. Sirois, J. D. Whittaker, **K. W. Lehnert**, R. W. Simmonds, *Nature*, **475**, 359–363 (2011).
- 26 “Quantum state tomography of an itinerant squeeze microwave field,” F. Mallet, M. A. Castellanos-Beltran, H. S. Ku, S. Glancy, E. Knill, K. D. Irwin, G. C. Hilton, L. R. Vale, and **K. W. Lehnert**, *Phys. Rev. Lett.*, **106**, 220502 (2011).
- 25 “Strongly quadrature-dependent noise in superconducting micro-resonators measured at the vacuum-noise limit,” J. Gao, L. R. Vale, J. A. B. Mates, D. R. Schmidt, G. C. Hilton, K. D. Irwin, F. Mallet, M. A. Castellanos-Beltran, **K. W. Lehnert**, J. Zmuidzinas, H. G. Leduc, *Appl. Phys. Lett.*, **98**, 232508 (2011).
- 24 “Design and Testing of Superconducting Microwave Passive Components for Quantum Information Processing,” H. S. Ku, F. Mallet, L. R. Vale, K. D. Irwin, S. E. Russek, G. C. Hilton, and **K. W. Lehnert**, *IEEE Trans. Appl. Superconductivity*, **21**, 452-455 (2011).
23. “Nanomechanical motion measured with imprecision below that at the Standard Quantum Limit,” J. D. Teufel, T. Donner, M. A. Castellanos-Beltran, J. W. Harlow, and **K. W. Lehnert**, *Nature Nanotechnology*, **4**, 820 - 823 (2009).
- 22 “Bandwidth and dynamic range of a widely tunable Josephson parametric amplifier,” M. A. Castellanos-Beltran, K. D. Irwin, L. R. Vale, G. C. Hilton, and **K. W. Lehnert**, *IEEE Trans. Appl. Superconductivity*, **19**, 944-947 (2009).
- 21 “Dynamical backaction of microwave fields on a nanomechanical resonator,” J. D. Teufel, J. W. Harlow, C. A. Regal and **K. W. Lehnert**, (editors’ selection) *Phys. Rev. Lett.*, **101**, 197203 (2008).
- 20 “Amplification and squeezing of quantum noise with a tunable Josephson metamaterial,” M. A. Castellanos-Beltran, K. D. Irwin, G. C. Hilton, L. R. Vale and **K. W. Lehnert**, *Nature Phys.*, **4**, 929 (2008).
- 19 “Prospects for cooling nanomechanical motion by coupling to a superconducting microwave resonator,” J. D. Teufel, C. A. Regal, and **K. W. Lehnert**. *New J. Phys.* **10** 095002

(2008). Invited paper for special issue: “Focus on Mechanical Systems at the Quantum Limit”

18 “Measuring Nanomechanical Motion with a Resonant Microwave Interferometer,” C. A. Regal, J. D. Teufel, and **K. W. Lehnert**, *Nature Phys.* **4**, 555 (2008).

17 “Demonstration of a multiplexer of dissipationless superconducting quantum interference devices,” J. A. B. Mates, G. C. Hilton, K. D. Irwin, L. R. Vale, and **K. W. Lehnert** *Appl. Phys. Lett.* **92**, 023514 (2008).

16 “Widely tunable parametric amplifier based on a superconducting quantum interference device array resonator,” M. A. Castellanos-Beltran and **K. W. Lehnert**, *Appl. Phys. Lett.* **91**, 083509 (2007).

15 “Evaluation of a microwave SQUID multiplexer prototype,” **K. W. Lehnert**, K. D. Irwin, M. A. Castellanos-Beltran, J. A. B. Mates and L. R. Vale, *IEEE Trans. Appl. Superconductivity* **17**, 705-709 (2007).

14 “Intrinsic noise properties of atomic point contact displacement detectors,” N. E. Flowers-Jacobs, D. R. Schmidt and **K. W. Lehnert**, *Phys. Rev. Lett.* **98**, 096804 (2007).

13 “A superconductor—insulator—normal metal bolometer with microwave readout suitable for large-format arrays,” D. R. Schmidt, **K. W. Lehnert**, A. M. Clark, W. Duncan, K. D. Irwin, N. Miller and J. N. Ullom, *Appl. Phys. Lett.* **86**, 053505 (2005).

12 “Microwave SQUID multiplexer,” K. D. Irwin and **K. W. Lehnert**, *Appl. Phys. Lett.* **85**, 2107-2109 (2004).

11 “Noise performance of the radio-frequency single-electron transistor,” L. Roschier, P. Hakonen, K. Bladh, P. Delsing, **K. W. Lehnert**, L. Spietz, and R. J. Schoelkopf, *J. Appl. Phys.* **95**, 1274 (2004).

10 “Primary electronic thermometry using the shot noise of a tunnel junction,” L. Spietz, **K. W. Lehnert**, I. Siddiqi, and R. J. Schoelkopf, *Science* **300**, 1929 (2003).

9 “Quantum charge fluctuations and the polarizability of the single electron box,” **K. W. Lehnert**, B. A. Turek, K. Bladh, L. F. Spietz, D. Gunnarsson, P. Delsing, and R. J. Schoelkopf, *Phys. Rev. Lett.* **91**, 106801 (2003).

8 “Measurement of the excited-state lifetime of a microelectronic circuit,” **K. W. Lehnert**, K. Bladh, L. F. Spietz, D. Gunnarsson, D. I. Schuster, P. Delsing, and R. J. Schoelkopf, *Phys. Rev. Lett.* **90**, 027002 (2003).

7 “A high-performance cryogenic amplifier based on a radio-frequency single electron transistor,” K. Segall, **K. W. Lehnert**, T. R. Stephenson, R. J. Schoelkopf, P. Wahlgren, A. Assime, and Per Delsing, *Appl. Phys. Lett.* **81**, 4859 (2002).

- 6 “Qubits as spectrometers of quantum noise,” R. J. Schoelkopf, A. A. Clerk, S. M. Girvin, **K. W. Lehnert**, and M. H. Devoret, in *Quantum Noise in Mesoscopic Physics* (Yu. V. Nazarov, Ed., Kluwer, 2003) cond-mat/0210247 (2002).
- 5 “Density-dependent critical currents in quantum-well-coupled weak links,” T. A. Eckhause, **K. Lehnert**, J. S. Correa, R. J. Jorstad, E. G. Gwinn, and M. Thomas, *Appl. Phys. Lett.* **81**, 3203 (2002).
- 4 “Mid-infrared studies of the contact region at superconductor-semiconductor interfaces,” T. A. Eckhause, S. Tsujino, **K. W. Lehnert**, E. G. Gwinn, S. J. Allen, M. Thomas, and H. Kroemer, *Appl. Phys. Lett.* **76**, 215 (2000).
- 3 “Nonequilibrium AC Josephson effect in mesoscopic Nb-InAs-Nb junctions,” **K. W. Lehnert**, N. Argaman, H.-R. Blank, K. C. Wong, S. J. Allen, E. L. Hu, and H. Kroemer, *Phys. Rev. Lett.* **82**, 1265 (1999).
- 2 “Nonequilibrium superconductivity in mesoscopic Nb/InAs/Nb junctions,” (Invited Paper) **K. W. Lehnert**, J. G. E. Harris, S. J. Allen, and N. Argaman, *Superlattices and Microstructures* **25**, 839 (1999).
- 1 “Spectroscopic study of Kondo insulator YbB<sub>12</sub> using a free electron laser,” H. Ohta, T. Nanba, **K. Lehnert**, S. J. Allen, M. Motokawa, F. Iga, and M. Kasaya, *J. Mag. Mag. Mat.* **341**, 177-181 (1998).

### **Conference Proceedings**

12. “Photon Efficient Electro-Optic Conversion via a Micromechanical Oscillator,” **K. W. Lehnert**, C. A. Regal, R. W. Peterson, N. S. Kampel, P. S. Burns, and A. P. Higginbotham, in Conference on Lasers and Electro-Optics, *OSA Technical Digest* (2016).
11. “Connecting microwave and optical frequencies with a vibrational degree of freedom,” R. W. Andrews, R. W. Peterson, T. P. Purdy, K. Cicak, R. W. Simmonds, C. A. Regal, **K. W. Lehnert**, *Proc. SPIE* **9343**, Laser Resonators, Microresonators, and Beam Control XVII, 934309 (2015).
10. “Progress towards quantum state transfer between microwave and optical light using an electro-optomechanical resonator,” R. Peterson, P. S. Burns, R. Andrews, T. P. Purdy, K. Cicak, R. W. Simmonds, C. A. Regal, and **K. W. Lehnert**, in *CLEO: 2015, OSA Technical Digest* (online) (Optical Society of America, 2015), paper FM3A.8 (2015).
9. “From Cavity Electromechanics to Cavity Optomechanics,” Cindy A. Regal and **Konrad W. Lehnert**, *Journal of Physics: Conference Series* **264**, 012025 (2011).
8. “Sensing nanomechanical motion with a shot-noise limited microwave cavity interferometer,” **Konrad W. Lehnert**, John D. Teufel, Tobias Donner, Jennifer W. Harlow and Manuel A. Castellanos-Beltran, in *Frontiers in Optics 2009/Laser Science XXV on CD-ROM* (Optical Society of America, Washington, DC, 2009), LSTuE3.

7. “Measuring and Cooling the Motion of a Nanomechanical Oscillator with a Microwave Cavity Interferometer,” **Konrad W. Lehnert**, John D. Teufel, in Laser Science XXIV, OSA Technical Digest (CD) (Optical Society of America, 2008), paper LMC1.
6. “Microwave SQUID multiplexers for low-temperature detectors,” K. D. Irwin, J. A. Beall, W. B. Doriese, W. D. Duncan, G. C. Hilton, J. A. B. Mates, C. D. Reintsema, D. R. Schmidt, J. N. Ullom, L. R. Vale, B. L. Zink, and **K. W. Lehnert**, International Workshop on Low Temperature Detectors (LTD-11), July 2006, Nucl. Instr. Meth. A **559**, 802 (2006).
5. “Normal metal-insulator-superconductor junction technology for bolometers,” D. R. Schmidt, W. D. Duncan, K. D. Irwin, **K. W. Lehnert**, N. A. Miller, J. N. Ullom, International Workshop on Low Temperature Detectors (LTD-11), July 2006, Nucl. Instr. Meth. A **559**, 516 (2006).
4. “The Shot Noise Thermometer: Primary Electronic Thermometry using the Noise from a Tunnel Junction,” L. Spietz, **K. W. Lehnert**, I. Siddiqi and R. J. Schoelkopf, IEEE Conference on Precision Electromagnetic Measurements Digest, 638-9 (2004).
3. “Observing single-electron tunneling events in a superconducting single electron transistor,” **K. W. Lehnert**, P. Wahlgren, Per Delsing, and R. J. Schoelkopf, 36<sup>th</sup> Recontres de Moriond Electronic Correlations: From meso- to nano-physics, January (2001).
2. “Nonequilibrium supercurrents in mesoscopic Nb-InAs-Nb junctions,” **K. W. Lehnert**, N. Argaman, H. R. Blank, K. C. Wong, S. J. Allen, E. L. Hu, and H. Kroemer, 4<sup>th</sup> International Symposium on New Phenomena in Mesoscopic Structures (NPMS 4), December 1998, Microelectronic Engineering **47**, 377 (1999).
1. “Dynamic nonequilibrium superconductivity and the half integer Shapiro step in mesoscopic SNS Josephson junctions,” **K. W. Lehnert**, N. Argaman, H. R. Blank, K. C. Wong, S. J. Allen, and H. Kroemer, Proceedings of the 24<sup>th</sup> International Conference on the Physics of Semiconductors (ICPS 24) D. Gershoni, Ed., World Scientific, Singapore (1998).

### **Patents**

“System and Method for Unidirectional Routing of Signals.” Chapman, B. J., Rosenthal, E. I., Kerckhoff, J., & **Lehnert, K. W.** Filed July 2017. Patent pending.

“Scalable Superconducting Qubit Measurement with Minimal Backaction,” Rosenthal, E. I., Schneider, Christian & **Lehnert, K. W.** Filed March 2020. Patent pending.

### **Professional Activities**

Organizer, Conference on Quantum Information and Systems for Fundamental Physics, Aspen Center for Physics, Aspen CO, February 18 – 22, 2020.

Member, Simon’s Observatory readout electronics review committee, 2019 – 2020.

Member, Advisory committee for Argonne National Labs Chemistry and Materials Initiative 2017.

Member, Scientific advisory committee, International Conference of Atomic Physics, August 2014.

Member, Scientific advisory committee, Abdus Salam International Centre for Theoretical Physics (ICTP) meeting on “Nano-opto-electro-mechanical systems approaching the quantum regime” September 2013.

Member, Scientific advisory committee, Kavli Institute of Theoretical Physics (KITP) program on “Quantum Control,” Spring 2013.

Chair, 2012 Gordon Conference on Mechanical Systems in the Quantum Regime

Member, IQEC subcommittee, IQEC/CLEO Pacific Rim Conference 2011

Vice-Chair, 2010 Gordon Conference on Mechanical Systems at the Quantum Limit

Member, Scientific advisory committee, Abdus Salam International Centre for Theoretical Physics (ICTP) meeting on “Nano-opto-electro-mechanical systems approaching the quantum regime” 2010.

Member of 2008 program committee for the International Conference on Nanoscience and Technology (ICN+T)

Organizer (founder), 1<sup>st</sup> workshop on Analog Quantum Information Processing, 2008

Organizer, Invited symposium on quantum microwave amplifiers at the 2008 Applied Superconductivity Conference, 2008

Organizer, CU Condensed Matter Seminar, 2004 – 2006

Scientific Organizer, Boulder Summer School, 2005

Member, American Physical Society 1995

Reviewer: Science, Nature, Physical Review Letters, Physical Review B, Nanoletters, European Physics Letters, Nature Physics, Nature Nanotechnology, Review of Scientific Instruments, Applied Physics Letters, Journal of Applied Physics, Physica Scripta, New Journal of Physics, National Science Foundation, German Research Foundation (DFG), US-Israel Binational Science Foundation

**Support:**

**Current:**

2018 – 2020 Fermi National Lab, Department of Energy “QuantISED: Quantum Metrology Techniques for Axion Dark Matter Detection,” Co-I \$260,000/yr to Lehnert group.

2017 – 2022 National Science Foundation – Physics Frontier Center, “JILA PFC,” Co-I, \$125,000/yr to Lehnert group.

2017 – 2021 ARO CQTS, “Photonic and Phononic Technologies for Superconducting Quantum Information Systems,” Co-I, \$300,000/yr to Lehnert group.

2014 – 2022 AFOSR MURI, “Wiring of quantum systems with mechanical oscillators,” PI, \$275,000/yr, to Lehnert research group.

2019 – 2022 National Science Foundation – Particle Astrophysics, “Collaborative research: HAYSTAC Subquantum,” PI, \$403,835

### **Recently completed:**

2016 – 2019, National Science Foundation – Particle Astrophysics “Collaborative research: Extreme Axion Experiment,” PI, \$413,057.

2015-2018, Heising-Simmons Foundation, “Extreme axion dark matter search,” PI, \$500,000.

2014-2017, ARL, “A hierarchical network based approach to superconducting qubit measurement,” PI, \$1,062,937, to Lehnert research group.

2013-2017, Betty and Gordon Moore Foundation, “Probing quantum effects of gravity in a table-top experiment,” PI, \$1,088,000 to Lehnert research group.

2010-2015, NSF, “Physics Frontier Center for Atomic, Molecular, and Optical Physics,” Co-I, \$175,000/ yr (est.) to Lehnert research group.

2013-2017, NSF, “Collaborative research: ADMX-HF Early Start”, PI, \$362,470 to Lehnert research group.

### **Extended Visits**

Lecturer: Les Houches summer school on Quantum Machines, July 15 – 26, 2019

Lecturer: Les Houches summer school on Optomechanics, August 10 – 23, 2015

Yale Quantum Institute visitor, June 8 – 26, Dec. 5 – 16, 2015

Lecturer: Les Houches summer school on Quantum Machines, July 6 – 23, 2011.

Distinguished visitor: University of Basel, Switzerland, May 1 – 15, 2010.

Sabbatical: Technical University Delft and Kavli Institute for Nanoscience, The Netherlands, August 16, 2010 – January 8, 2011.

### **Courses**

Phys 4230, Thermodynamics and Statistical Mechanics, Fall 2016

Phys 3210, Classical Mechanics and Math Methods 2, Fall 2018, Fall 2014, Fall 2011

Phys 3330, Electronics for the Physical Sciences, Spring 2013, Spring 2009, Fall 2007

Phys 5840, Directed reading (Quantum mechanics of electrical circuits), Fall 2010

Phys 4340, Introduction to Solid State Physics, Spring 2006

**Current and Former Advisees**

Post-doctoral scientists

Daniel R. Schmidt  
Cindy A. Regal  
John D. Teufel  
U. Tobias Donner  
François Mallet  
Tauno Palomaki  
Joseph Kerckhoff (NRC)  
Michael Schroer (NRC)  
Jéréemie Viennot  
Brad Moores  
Andrew Higginbotham (NRC)  
Maxime Malnou  
Ben Brubaker (NRC)  
Brendon Rose  
Jonathan Kindem (NRC)  
Yue Jiang

Graduate students

Manuel Castellanos-Beltran  
Nathan Flowers-Jacobs  
Jennifer Harlow  
Hsiang-Sheng Ku  
Reed Andrews  
William Kindel  
Adam Reed  
Mehmet Anil  
Daniel Palken  
Benjamin Chapman  
Peter Burns  
Xizheng Ma  
Eric Rosenthal  
Lucas Sletten  
Robert Delaney  
Sarang Mittal  
Ziyi Zhou  
Elizabeth Ruddy  
Kazemi Adachi  
Pablo Sanchez

Undergraduates or Masters students

Brandon Smith  
Michael Demoret  
Scott Hoch  
Bradley Miller  
Gerwin Koolstra (Delft)  
Daniel Matthias  
Juan Montoya  
Tim Menke (ETH Zurich)  
Nicole Ehrlich  
Justin White  
Kelly Wurtz  
Christian Schneider (Innsbruck)  
Adam Farmer

### **Outreach, Service and other Activities**

Faculty mentor for Gordon Research Seminar “Mechanical Systems in the Quantum Regime,” March 5 – 6, 2016, Ventura, CA.

Participant in CU Wizards Program. Created and presented show called “Waves and Radios: the physics of the information age,” March 14, 2015; May, 18, 2013; and June 11, 2011

Faculty advisor for the Society of Physics Students (2011-2012).

Titular advisor for:

Nathan Tomlin, né Miller  
Joshua Strong  
John (Ben) Mates  
Shannon Sankar

REU advisor for:

Julie Bert, 2004, (Physics graduate student, Stanford)  
Brandon Smith, 2006, (Physics graduate student, Michigan)  
Benjamin Zimmerman, 2006, (Industry)

Dissertation or Advancement committee member for:

Karl Mayer, Katherine McCormick, Gabriel Peterson, Susan Todaro, Robert Peterson, Marek Pechal (ETH Zurich), Nathan Hinkley, Ben Yu, Sarah McGee, Jennifer Taylor, Zilong Chen, Vincent Mourik (Delft), David Hume, John Jost, Jed Whittaker, Isabell Thomann, Richard Sandberg, James Schlaerth, Mark Siemens, Feng Pan, Shawn Tanner, Chi-fong Lei, Ra’anan Tobey, Xiaoshi Zhang, Ian Coddington, Seth Foreman, Lieko Earle, Amy Lytle, Ashley Carter, Amanda Carpenter, Ariel Paul, Volker Schweikhard, Virginia Lorenz, Martha Baylor, Martha Hosotani, Marty Boyd, Chris Ticknor, Rajiv Bhat, Deborah Krause

Other committee work:

Physics department search committee (chair) (2018-19)  
JILA search committee (2016-17)  
Helium committee (2015 -)  
Physics condensed matter search (2014)  
Graduate admission committee (2012-2013)  
JILA Cleanroom, Fellow representative (2014 - )  
Physics energy initiative search (2009)  
Physics condensed matter search (2006)  
JILA colloquium (2007)  
Supply office, Fellow representative

### **Invited Presentations**

“Single Phonon Electromechanics,” MaQsens workshop, Oburgurgl, Austria, Feb. 11, 2020.

“Making Sound Matter,” Colloquium, University of Colorado, Boulder, Boulder CO, Feb. 5 2020.

“The sound of quantum mechanics,” Colloquium, University of New Mexico Physics and Astronomy Dept., Albuquerque NM, Oct. 4, 2019.

“Quantum metrology for fundamental physics,” CQuIC seminar: University of New Mexico, Albuquerque NM, Oct. 3, 2019.

“Quantum metrology for fundamental physics,” ITAMP Laboratory Cosmology Workshop, Cambridge MA, September 16<sup>th</sup>, 2019

“Searching for ultralight dark matter with superconducting quantum technology,” Aspen Center for Physics workshop on Quantum information and High Energy Physics, Aspen CO, May 22, 2019.

“Accelerating the search for axionic dark matter with quantum information technology,” APS April Meeting, Denver CO, April 13<sup>th</sup>, 2019.

“A quantum-enhanced search for a weak microwave signal with application to axion detection,” Quantum Sensors for Fundamental Physics Workshop, St. Catherine’s college Oxford, Oxford UK, October 16<sup>th</sup>, 2018.

“Accelerating axion dark matter searches with quantum information technology,” Oxford Physics Department seminar, Oxford UK, October 15<sup>th</sup>, 2018.

“Transmon qubits coupled to surface acoustic wave resonators,” Seminar at IOQOI, Innsbruck, Austria, April 11<sup>th</sup>, 2018.

“The Sound of Quantum Mechanics,” Seminar at the University of Vienna, Vienna, Austria, April 10<sup>th</sup>, 2018.

“Non-classical states of motion,” Gordon Research Conference on Mechanical Systems in the Quantum Regime, Ventura, CA, February 26, 2018.

“Superconducting sensors at and beyond the quantum limit,” Committee on Particles and Detectors (CPAD) Workshop, Argonne National Lab, IL, December 12, 2017.

“The Sound of Quantum Mechanics,” National Institute of Standards and Technology, Physical Measurements Laboratory Colloquium, October 30, 2017.

“Harnessing quantum technologies in the search for dark matter,” Committee on Particles and Detectors (CPAD) meeting, Albuquerque NM, October 13, 2017.

“Accelerating axion dark matter searches with quantum information technology,” Perimeter institute workshop on experimental techniques for laboratory scale fundamental physics, Waterloo, Canada, August 21<sup>st</sup>, 2017.

“Faithful transfer of propagating quantum information to mechanical motion,” Plenary talk at Quantum Technology Conference, Espoo, Finland, August 5, 2017.

“The sound of quantum mechanics,” Colloquium at the Austrian Institute of Science and Technology, Vienna, Austria, June 15, 2017.

“Quantum transduction between the microwave and optical domains,” Workshop on quantum networking, Calgary, Canada, May 28, 2017.

“Transmon qubits coupled to surface acoustic wave cavities,” CIFAR Quantum Cavities meeting, near Sherbrooke, Canada, May 15, 2017.

“The sound of quantum mechanics,” Condensed matter seminar, University of Massachusetts, Amherst, MA, April 20, 2017.

“Micromechanics: a new quantum technology,” Pittsburgh quantum institute colloquium, Pittsburgh, PA, March 27, 2017

“Quantum transduction with mechanical oscillators,” March meeting, American Physical Society, New Orleans, LA, March 13, 2017

“Circumventing quantum noise in axion dark matter searches,” Fermi lab particle astrophysics seminar, Batavia IL, Nov. 19, 2016.

“Quantum transduction between the microwave and optical domains,” Optical Society of America Meeting, San Jose CA, June 8, 2016.

“Quantum Electromechanics,” Weizmann Institute, Physics Colloquium, Rehovot, Israel, April, 19, 2016.

“Processing nonclassical microwave signals with mechanical oscillators,” Gordon Research Conference on Quantum science, Easton, MA, August 3, 2016.

“Quantum Electromechanics,” Stanford University, Physics Colloquium, Palo Alto, CA, March 2, 2016.

“Towards a quantum interface between electricity and light,” Physics of Quantum Electronics Conference, Snowbird, UT, Jan. 5, 2016.

“An introduction to quantum electromechanics,” Short course presented at the Yale Quantum Institute, Dec. 11, 2015.

“Quantum Electromechanics,” Physics colloquium, The University of Wisconsin, Madison, WI, Dec. 4, 2015.

“Noiseless mode conversion of microwave fields,” Dense Light conference, KITP, Santa Barbara, CA, Oct. 5, 2015.

“Circumventing quantum noise in axion dark matter searches,” Axion Cavities Workshop, Lawrence Livermore National Laboratory, Livermore, CA, August 27, 2015.

“Improving superconducting qubit measurements: a hierarchical, network based approach,” Quantum Computing Program Review, Pentagon City, VA, July 22, 2015.

“Analog signal processing with electromechanics in the quantum regime,” Yale Quantum Institute seminar, Yale U., New Haven, CT, June 14, 2015.

“Analog signal processing with electromechanics in the quantum regime,” Quantum Cavities meeting, Aachen, Germany, May 28, 2015.

“Quantum enhanced axion dark matter search,” Conference on the Intersections of Particle and Nuclear Physics, Vail, Colorado, May 23, 2015.

“Micromechanics: a new quantum technology,” Condensed matter seminar, University of Utah, Salt Lake City, Utah, February 24, 2015.

“Analog quantum signal processing with electromechanics,” ITAMP workshop on Hybrid Quantum Systems, Oracle, Arizona, February 17, 2015.

“Towards a quantum interface between electricity and light,” Physics of quantum electronics conference, Snowbird, Utah, January 5, 2015.

“Analog quantum information processing with mechanical oscillators,” Heraeus Foundation Seminar: Designed Quantum States of Matter, Bad Honnef, Germany, December 3, 2014.

“Micromechanics: a new quantum technology,” Berkeley Physics department colloquium, Berkeley, CA, October 13, 2014.

“Improving superconducting qubit measurements :a hierarchical, network based approach,” Quantum Computing Program Review, Arlington VA, August 14, 2014.

“Micromechanics: a new quantum technology,” Yale University physics colloquium, New Haven, CT, April 28, 2014.

“Transduction with opto-electromechanical circuits,” Gordon Research Conference: Mechanical Systems in the Quantum Regime, Ventura CA, March 10, 2014.

“Electro-opto-mechanics: towards a quantum interface between electricity and light,” Symposium in honor of Michel Devoret’s 60<sup>th</sup> Birthday, Yale University, December 14, 2013.

“Enabling quantum technologies with micromechanical oscillators,” International Symposium on Nanoscale Transport and Technology, Atsugi, Japan, November 28, 2013.

“Enabling quantum technologies with micromechanical oscillators,” University of California, Merced, Physics Colloquium, November 15, 2013.

“Enabling quantum technologies with micromechanical oscillators,” Center for Ultracold Atoms Seminar, Cambridge, Massachusetts, October 22, 2013.

“Enabling quantum circuits with electromechanical devices,” Center for Nanoscience Symposium (CeNS), Venice, Italy, September 16, 2013.

“Enabling quantum circuits with electromechanical devices,” Frontiers in Quantum Engineered Devices, Obergurgl, Austria, August 24, 2013.

“Enabling quantum circuits with electromechanical devices,” Rencontres du Vietnam, Quy Nhon, Vietnam, August 8, 2013.

“Dynamical control of electromechanical networks,” Quantum Nano- and Micromechanics, Ascona, Switzerland, July, 22, 2013.

“Electro-opto-mechanics: Towards a quantum interface between electricity and light” Canadian Institute for Advanced Research, Quantum Cavities Meeting, Montreal, Canada, May 4, 2013.

“Micro-electromechanics: A new quantum technology,” McGill University, Physics Colloquium, Montreal, Canada, March, 1, 2013.

“Using a mechanical resonator to catch, store, and release propagating microwave fields,” Southwest Quantum Information and Technology Meeting (SQuInT), Santa Barbara, California, February 23, 2013.

“Micro-electromechanics: A new quantum technology,” University of Southern California, Munushian Lecture, Los Angeles, California, February 8, 2013.

“Quantum transduction with micro-mechanical oscillators,” Summit of Materials Science, Sendai, Japan, November 28, 2012.

“Quantum electro-mechanics, a new quantum technology,” University of Colorado Physics Colloquium, Boulder, Colorado, September 12, 2012.

“Microwave to optics quantum state transfer,” DARPA OrCHID review meeting, Santa Barbara, California, August 29, 2012.

“Fishing for photons: using a mechanical resonator to catch, store, and release propagating microwave fields,” Nano-MRI meeting, Ascona, Switzerland, July 26, 2012.

“Quantum electro-mechanics, a new quantum technology,” Nano-mechanical resonator seminar series, College de France, Paris, France, May 22, 2012.

“Quantum control of mechanical oscillators,” APS March Meeting, Boston, Massachusetts, February 27, 2012.

“Micro-electromechanics: A new quantum technology,” University of Illinois, Physics Colloquium, Urbana, Illinois, February 15, 2012.

“Micro-electromechanics: A new quantum technology,” Joint Quantum Institute seminar, College Park, Maryland, January 30, 2012.

“State preparation, measurement, and control of mechanics in the quantum regime,” Fundamenteel Onderzoek der Materie (FOM) annual meeting, Veldhoven, Netherlands, January 17, 2012.

“Sensing the quantum motion of a nanomechanical oscillator,” Meeting of the National Academy Committee on Atomic, Molecular, and Optical Science (CAMOS), Washington, DC, October 3, 2011.

“Sensing the quantum motion of a nanomechanical oscillator,” Stanford Photonics Research Center Symposium, Palo Alto, California, September 12, 2011.

“Quantum state tomography of itinerant microwave fields,” Quantum Information Processing Conference, Zurich, Switzerland, September 8, 2011.

“Sensing the quantum motion of a nanomechanical oscillator,” International seminar on nanomechanical systems, Toulouse, France, July 4, 2011.

“Can acoustics be quantum?” German-American Kavli Frontiers of Science Symposium, Irvine, California, April 10, 2011.

“Generating and verifying quantum entanglement with Analog Quantum Integrated Circuits (AQICs),” DARPA QuEST Program Review, Dana Point, California, March 31, 2011.

“Can acoustics be quantum?” University of Toronto physics colloquium, Toronto, Canada, February 17, 2011.

“Can acoustics be quantum?” Syracuse University physics colloquium, Syracuse, New York, February 10, 2011.

“Microwave to optical quantum state transfer,” DARPA ORCHiD review meeting, Biosphere 2, Arizona, January 17, 2011.

“Quantum effects in mechanical motion,” Japan-America Frontiers of Science Symposium, Kazusa Arc, Japan, December 5, 2010.

“Sensing the quantum motion of a nanomechanical oscillator,” Zernike Seminar, Groningen University, Groningen, The Netherlands, November 19, 2010.

“Efficient quantum measurement and cooling of nanomechanical motion,” Ecole Normale Superior, Paris, France, November 11, 2010.

“Can Acoustics be quantum?” Harvard University, ITAMP seminar, Cambridge, Massachusetts, November 3, 2010.

“Efficient quantum measurement and cooling of nanomechanical motion,” Yale University, SSO Seminar, New Haven, Connecticut, November 2, 2010.

“Efficient quantum measurement and cooling of nanomechanical motion,” Optical Society of America meeting, Rochester, New York, October 25, 2010.

“Amplification, Squeezing and Entanglement generation with an electrical circuit, Ecole Polytechnique Federale de Laussane (EPFL), Lausanne, Switzerland, October 15, 2010.

“Efficient quantum measurement and cooling of nanomechanical motion,” TU Delft, quantum nanoscience seminar, Delft, The Netherlands, October 13, 2010.

“Efficient quantum measurement and cooling of nanomechanical motion,” Linnaeus Lecture, Chalmers University, Goteborg, Sweden, Oct. 7, 2010.

“Quantum metrology,” (6 hour lecture series) Linnaeus summer school on Quantum Engineering, Hindås, Sweden, June 30, 2010.

“Mechanically mediated quantum-state transfer between microwave and optical photons,” DARPA ORCHiD kickoff meeting, Santa Barbara, California, June 17, 2010.

“State Tomography of a Squeezed, Itinerant Microwave Field,” University of Basel, special colloquium, Basel, Switzerland, May 5, 2010.

“State Tomography of a Squeezed, Itinerant Microwave Field,” Canadian Institute for Advanced Research, Quantum Cavities meeting, Montreal, Canada, April 10, 2010.

“State Tomography of a Squeezed, Itinerant Microwave Field,” DARPA QuEST review, Washington, DC, April 11, 2010.

“Noiseless amplification, squeezing, and entanglement generation with an electrical circuit,” Waseda University: meeting on “Quantum Technologies: Information and Communication,” Tokyo, Japan, Dec. 10, 2009.

“Quantum Measurement of Motion Using a Microwave Interferometer,” NTT Seminar, Atsugi, Japan, December 8, 2009.

“Quantum Measurement of Motion Using a Microwave Interferometer,” ETH Zürich Physics Colloquium, Zürich, Switzerland, October 21, 2009.

“Sensing Nanomechanical Motion with a Shot-Noise Limited Microwave Cavity Interferometer,” OSA/APS joint meeting of Frontiers in Optics and Laser Science, San Jose, California, Oct. 13, 2009.

“Quantum measurement of motion using a microwave interferometer,” Center for the Physics of Materials (CPM) Seminar, McGill University, Montreal, Canada, September 24, 2009.

“Quantum efficient measurement of nanomechanical motion with precision beyond the standard quantum limit,” Wilhelm and Else Heraeus foundation-Seminar on “Quantum Optics of Nano- and Micromechanical Systems,” Bad Honnef, Germany, July 21, 2009.

“Amplification, squeezing and entanglement generation with electrical circuits,” TU Delft, Applied Nanoscience Seminar, Delft, Netherlands, July 16, 2009.

“Efficient quantum measurement of nanomechanical motion,” The international Workshop on Solid State Based Quantum Information Processing, Herrsching, Germany, July 2, 2009.

“Mesoscopic systems coupled to mechanical structures,” Introductory talk for Atomic Physics Gordon conference session on “Mesoscopics and Condensed Matters Systems,” Tilton, New Hampshire, June 30, 2009.

“Microwave cavity optomechanics: Measuring and cooling the motion of nanomechanical oscillators with microwave ‘light’,” IQC Colloquium, Institute for Quantum Computing, Waterloo, Canada, June 1, 2009.

“Measuring and cooling the motion of nanomechanical oscillators with microwave ‘light’,” Keynote address of the Denver University Nanoscience symposium, Denver, Colorado, May 26, 2009.

“Microwave Cavity Optomechanics,” Wilhelm and Else Heraeus Foundation Seminar on “Microwaves for Condensed Matter Physics,” in Bad Honnef, Germany, April 8, 2009.

“Optomechanics with microwave light,” Keithley Award Session, APS March meeting, Pittsburgh, Pennsylvania, March 18, 2009.

“Microwave cavity optomechanics: Measuring and cooling the motion of nanomechanical oscillators with microwave ‘light’,” NIST Boulder Seminar, Boulder, Colorado, March 4, 2009.

“Analog Quantum Integrated Circuits,” DARPA QuEST kickoff meeting, Duck Key, Florida, January 27, 2009.

“Cooling and measuring the motion of a nanomechanical oscillator with microwave fields,” Center for Advanced Studies seminar, Albuquerque, New Mexico, Dec. 4, 2008.

“Cooling and measuring the motion of a nanomechanical oscillator with microwave fields,” Berkeley Nanoscience and Nanoengineering Institute seminar, Berkeley, California, Nov. 14, 2008.

“Cooling and measuring the motion of a nanomechanical oscillator with microwave fields,” OSA/APS joint meeting of Frontiers in Optics and Laser Science, Rochester, New York, Oct. 20, 2008.

“Forget Energy, Conserve Information,” JILA Colloquium, Boulder, Colorado, Oct. 14, 2008.

“Sensing Nanomechanical Motion with a Resonant Microwave Interferometer,” International Conference on Nanoscience + Technology (ICN+T), Keystone, Colorado, July 21, 2008.

“Measuring and cooling the motion of a nanomechanical oscillator embedded in a microwave cavity,” Quantum Information and Control in Queensland (QICIQ) conference, Palm Cove, Australia, July 1, 2008.

“Amplification and Squeezing of Quantum Noise,” 2<sup>nd</sup> Workshop on the Physics and Applications of Superconducting Microresonators (scresonators08), Utrecht, Netherlands, June 19, 2008.

“Sensing nanomechanical motion with a resonant microwave interferometer,” Special Seminar at the Max Planck Institut für Quantenoptik (MPQ), Garching, Germany, June 18, 2008.

“Measuring and cooling the motion of a nanomechanical oscillator embedded in a microwave cavity,” Los Alamos theory division seminar, Los Alamos, New Mexico, March 21, 2008.

“Sensing nanomechanical motion with a resonant microwave interferometer,” Colorado School of Mines, Physics Colloquium, Golden, Colorado, March 11, 2008.

“Sensing nanomechanical motion with a resonant microwave interferometer,” Caltech Applied Physics Seminar, Pasadena, California, February 27, 2008.

“Detecting nanomechanical motion with resonant microwave interferometry,” Pomona

College, Physics and Astronomy Colloquium, Claremont California, February 26, 2008.

“Microwave optomechanics: detection and feedback control of a nanomechanical element with resonance microwave interferometry,” Gordon conference on Mechanical Systems in the Quantum Regime, Ventura, California, February 18, 2008.

“Sensing nanomechanical motion with a microwave interferometer,” Institut für Quantenoptik und Quanteninformation, Innsbruck, Austria, September 12, 2007.

“Detecting nanomechanical motion with atomically sharp points and microwave resonant cavities,” Séminaire "Nanoélectronique Quantique" CNRS, Grenoble, France, July 20, 2007.

“Detecting Nanomechanical Motion with Atomically Sharp Points or Microwave Resonators,” Quantum Information Science Gordon Conference, Il Ciocco, Italy, April 18, 2007.

“A Microwave SQUID Multiplexer Prototype,” First Workshop on Physics and Applications of Superconducting Microresonators, Pasadena, California, March 19, 2007.

“Intrinsic Noise Properties of an Atomic Point Contact Amplifier,” Caltech optics seminar, Pasadena, California, February 23, 2007.

“Intrinsic Noise Properties of an Atomic Point Contact Amplifier,” second workshop on quantum electro-mechanics (QEM-2), Morro Bay, California, December 13, 2006.

“Sensing femtometer motion with atomic point contact amplifiers,” Colloquium at the Aspen Center for Physics Workshop on Interaction, Coherence and Control in Mesoscopic Systems, Aspen, Colorado, July 2006.

“The microwave atomic point contact: A fast and ultrasensitive detector of nanomechanical motion,” Ohio State University, Condensed Matter Seminar, Columbus, Ohio, September 2005.

“A microwave atomic point contact displacement detector,” Yale Solid-State Seminar, New Haven, Connecticut, March 2005.

“Ultrasensitive bolometers and calorimeters,” NIST Quantum Physics Division Seminar, Gaithersburg, Maryland, June 2004.

“Quantum fluctuations in the single electron box,” APS March meeting, Austin, Texas, March 2004.

“Quantum corrections to the polarizability of the single electron box,” Canadian Institute for Advanced Research, Quantum Materials Meeting, Montreal, Canada, March 2004.

“Precision electrometry: quantum fluctuations and SET backaction,” Meeting of the Euromet “Count” project, Bern-Wabern, Switzerland, November 2002.

"Coherence Time and Excited-state Lifetime of a Cooper-pair Box," Condensed Matter Seminar, Harvard University, Division of Engineering and Applied Sciences, Cambridge Massachusetts, April 5, 2002.

"Decoherence time and excited-state lifetime of a Cooper-pair box," APS March meeting, Indianapolis, Indiana, March 2002

"Coherence Time and Excited-state Lifetime of a Cooper-pair Box," Cornell LAASP Solid State and Theory Seminars, Ithaca, New York, February 26, 2002.

"Quantum computing with Cooper Pair Box," Physics-Astronomy Seminar, Michigan State University, East Lansing, Michigan, January 21, 2002.

"Probing the coherence of single cooper-pair qubits using fast electrometry," Progress in Electromagnetic Research Symposium (PIERS), Cambridge, Massachusetts, July 2000.