

## **Konrad W. Lehnert**

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### **Personal Information**

Born: January 22, 1971 in Bogotá, Colombia  
Citizenship: United States

### **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, May 1993

### **Appointments**

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

*JILA Fellow*, September 2007-present

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

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

*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

## **Professional Associations and Activities**

Member, American Physical Society  
Scientific Organizer, Boulder Summer School, 2004  
Organizer, CU Condensed Matter Seminar, 2004 – 2006  
Reviewer: Science, Physical Review Letters, Physical Review B, Nanoletters,  
European Physics Letters  
Scientific Organizer, Third Workshop on Quantum Electro-mechanical Systems  
(QEM-3).  
Chair (pending approval of meeting), Gordon Conference on Mechanical Systems  
at the Quantum Limit (2012)

## **Refereed Publications**

“Amplification and squeezing of quantum noise with a tunable Josephson metamaterial,”  
M. A. Castellanos-Beltran, K. D. Irwin, G. C. Hilton, L. Vale and **K. W. Lehnert**, Nature  
Physics (submitted).

“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. (submitted).

“Measuring nanomechanical motion with a microwave cavity interferometer,”  
C. A. Regal, J. D. Teufel and **K. W. Lehnert**, Nature Physics **4**, 555-560 (2008)

“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**, 023514/1-3 (2008).

“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**, 083509/1-3 (2007).

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

“Intrinsic noise properties of atomic point contact displacement detectors,”  
N. E. Flowers-Jacobs, D. R. Schmidt and **K. W. Lehnert**, Phys. Rev. Lett. **98**, 096804/1-  
4 (2007).

“A superconductor—insulator—normal metal bolometer with microwave readout  
suitable for large-format arrays,”

D. R. Schmidt, A. M. Clark, W. Duncan, K. D. Irwin, N. Miller, J. N. Ullom and **K. W. Lehnert**, Appl. Phys. Lett. **86**, 053505 (2005).

“Microwave SQUID multiplexer,”

K. D. Irwin and **K. W. Lehnert**, Appl. Phys. Lett. **85**, 2107-2109 (2004).

“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).

“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).

“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).

“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).

“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).

“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).

“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).

“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).

“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).

“Nonequilibrium superconductivity in mesoscopic Nb/InAs/Nb junctions,” (Invited Paper)

**K. W. Lehnert**, J. G. E. Harris, S. J. Allen, and N. Argaman, *Superlatt. Microstr.* **25**, 839 (1999).

“Spectroscopic study of Kondo insulator  $\text{YbB}_{12}$  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 Papers**

“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).

“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.

“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).

“Dynamic nonequilibrium superconductivity and the half integer Shapiro step in mesoscopic SNS Josephson junctions,” Proceedings of the 24<sup>th</sup> International Conference on the Physics of Semiconductors (ICPS 24) (D. Gershoni, Ed., World Scientific, Singapore, 1998).

### **Selected Invited Presentations**

“Microwave optomechanics: detection and feedback control of a nanomechanical element with resonance microwave interferometry,” Gordon Conference on Mechanical Systems in the Quantum Regime, 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, March 19, 2007.

“Intrinsic noise properties of an atomic point contact amplifier,” Caltech optics seminar, Pasadena, CA, February 23, 2007.

“Intrinsic noise properties of an atomic point contact amplifier,” Second Workshop on Quantum Electro-mechanics (QEM-2), Morro Bay, CA, 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, CO, July 2006.

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

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

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

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

“Decoherence time and excited-state lifetime of a Cooper-pair box,” APS March meeting 2002.

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

### **Courses**

Phys 3330, Electronics for the Physical Sciences, Fall 2007

Phys 4340, Introduction to Solid State Physics, Spring 2006

Phys 7840, Selected Topics (Physics of Single Electron Devices), Fall 2003

### **Current and Former Advisees**

Post-doctoral scientists

Daniel Schmidt (NIST Boulder staff)  
Cindy Regal (Caltech)  
John Teufel

Graduate students

Manuel Castellanos-Beltran  
Nathan Flowers-Jacobs  
Jennifer Harlow

Undergraduates

Brandon Smith (Michigan)  
Michael Demoret

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

Titular advisor for:

Nathan Miller  
Joshua Strong

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:

Mark Scharleth, Mark Siemens, Feng Pan, Shawn Tanner, Chi-fong (Tim) Lei,  
Ra'anana 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 condensed matter search (2006)  
JILA colloquium (2007)  
Supply office, Fellow representative