

**Robert J. Schoelkopf**  
**Curriculum Vitae**

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e-mail: [Robert.Schoelkopf@yale.edu](mailto:Robert.Schoelkopf@yale.edu)

Education: Princeton University, A.B. (1986), Physics, *cum laude*.  
California Institute of Technology, Ph.D. (1995), Physics.

Experience:

Professor of Applied Physics and Physics, Yale University (July 2003- present)  
Co-Director of Yale Center for Microelectronic Materials and Structures  
Associate Director, Yale Institute for Nanoscience and Quantum Engineering

Visiting Professor of Physics, University of New South Wales, Australia (March-June 2008)

Asst. Professor of Applied Physics and Physics, Yale University (July 1998-July 2003)

Associate Research Scientist and Lecturer,  
Department of Applied Physics, Yale University (Jan. 1995-July 1998).

Graduate Research Assistant, Department of Physics,  
California Institute of Technology (1988-1994).

Electrical/Cryogenic Engineer, Laboratory for High-Energy Astrophysics,  
NASA/Goddard Space Flight Center (1986-1988).

Honors: Fellow of American Association for the Advancement of Science (2007)  
Fellow of American Physical Society (2005)  
Member of Defense Science Study Group (2004-2005)  
Yale University Junior Faculty Fellowship (2002-2003)  
David and Lucille Packard Foundation Fellow (2000-2005)  
Semi-finalist, Discover Magazine Technological Innovation of the Year (1999); "The RF-SET"  
NASA Technical Innovator Award (co-recipient) 1996;  
NASA Graduate Student Researcher Fellowship (1989-1992).

Personal: Born New York, NY, Jan. 24, 1964. U.S. Citizen. Married, two children.

Patents: U.S. Patent # 5696372: "High Efficiency Near-Field Electromagnetic Probe Having a Bow-Tie Antenna Structure," R.D. Grober, R.J. Schoelkopf, and D.E. Prober.

Advisors: T.G. Phillips, J. Zmuidzinas, D.E. Prober.

Collaborators: S. Girvin, M.H. Devoret, M.D. Lukin, J.M. Doyle, D. DeMille, P. Zoller

Postdoctoral Advisees: K. Lehnert, A. Wallraff, K. Segall, A. Houck, J. Majer

## Robert J. Schoelkopf

### Publications:

- 1) **“Advances Toward High Spectral Resolution Quantum X-Ray Calorimeters,”**  
S.H. Moseley, R.L. Kelley, R.J. Schoelkopf, A.E. Szymkowiak, D. McCammon, and J. Zhang, *IEEE Trans. on Nuclear Science*, **35**, 59 (1988).
- 2) **“High Resolution Microcalorimeters as Detectors for Inelastic Scattering,”**  
A. Szymkowiak, R.L. Kelley, G. Madejski, S.H. Moseley, R.J. Schoelkopf, B. Edwards, M. Juda, D. McCammon, M. Skinner, and J. Zhang,  
*Rev. of Sci. Inst.*, **60**, 1557 (1989).
- 3) **“Detection of Coherent 7.6Hz Oscillations During a Burst From Aquila X-1,”**  
R.J. Schoelkopf and R.L. Kelley, *Ap. J.*, **375**, 696 (1991).
- 4) **“A 100 GHz Josephson Mixer Using Resistively-Shunted Nb Tunnel Junctions,”**  
R.J. Schoelkopf, T.G. Phillips, and J. Zmuidzinas,  
*IEEE Trans. on Appl. Supercond.*, **3**, 2250 (1993).
- 5) **“Measurements of Noise in Josephson-effect Mixers,”**  
R.J. Schoelkopf, J. Zmuidzinas, T.G. Phillips, H.G. LeDuc, and J.A. Stern,  
*IEEE Trans. on Microwave Theory and Techniques*, **43**, 977 (1995).
- 6) **“Large Bandwidth and Low Noise in a Diffusion-cooled Hot-Electron Bolometer Mixer,”**  
A. Skalare, W.R. McGrath, B. Bumble, H.G. LeDuc, P.J. Burke, A.A. Verheijen, R.J. Schoelkopf, and D.E. Prober, *Appl. Phys. Lett.*, **68**, 1558 (1996).
- 7) **“Length Scaling of Bandwidth and Noise in Hot-electron Superconducting Mixers,”**  
P.J. Burke, R.J. Schoelkopf, D.E. Prober, A. Skalare, W.R. McGrath, B. Bumble, and H.G. LeDuc, *Appl. Phys. Lett.*, **68**, 3344 (1996).
- 8) **“Noise Bandwidth of Diffusion-Cooled Hot-electron Bolometers,”**  
R.J. Schoelkopf, P.J. Burke, D.E. Prober, B. Karasik, A. Skalare, W.R. McGrath, M.C. Gaidis, B. Bumble, and H.G. LeDuc,  
*IEEE Trans. on Appl. Superconductivity*, **7**, 3576 (1997).
- 9) **“Optical Antenna: Towards a Unity Efficiency Near-Field Optical Probe,”**  
R.D. Grober, R.J. Schoelkopf, and D.E. Prober, *Appl. Phys. Lett.*, **70**, 1354 (1997).
- 10) **“Frequency Dependence of Shot Noise in a Diffusive Mesoscopic Conductor,”**  
R.J. Schoelkopf, P.J. Burke, A. A. Kozhevnikov, D.E. Prober, and M.J. Rooks,  
*Phys. Rev. Lett.*, **78**, 3370 (1997).
- 11) **“Spectrum of Thermal Fluctuation Noise in Diffusion and Phonon Cooled Hot-electron Mixers,”**  
P.J. Burke, R.J. Schoelkopf, D.E. Prober, B. Karasik, A. Skalare, W.R. McGrath, M.C. Gaidis, B. Bumble, and H.G. LeDuc, *Appl. Phys. Lett.*, **72**, 1516 (1998).
- 12) **“Observation of Photon-Assisted Noise in a Phase-Coherent Conductor,”**  
R.J. Schoelkopf, A.A. Kozhevnikov, D.E. Prober, and M.J. Rooks,  
*Phys. Rev. Lett.*, **80**, 2437 (1998).
- 13) **“The Radio-Frequency Single-Electron Transistor (RF-SET): A Fast and Ultra-Sensitive Electrometer,”**  
R.J. Schoelkopf, P. Wahlgren, A.A. Kozhevnikov, P. Delsing, and D.E. Prober,  
*Science* **280**, 1238 (1998).
- 14) **“A Concept for a Submillimeter-Wave Single-Photon Counter,”**  
R.J. Schoelkopf, S.H. Moseley, C.M. Stahle, P. Wahlgren, and P. Delsing,  
*IEEE Trans. on Applied Superconductivity*, **9**, 2935 (1999).

## Robert J. Schoelkopf

### Publications (cont.):

- 15) ***“Mixing and Noise in Diffusion and Phonon Cooled Superconducting Hot-electron Bolometers,”***  
P.J. Burke, R.J. Schoelkopf, D.E. Prober, A. Skalare, B.S. Karasik, M.C. Gaidis, W.R. McGrath, B. Bumble, and H.G. LeDuc, *J. Appl. Phys.* **85**, 1644 (1999).
- 16) ***“Amplifying Quantum Signals with the Single-electron Transistor,”***  
M.H. Devoret and R.J. Schoelkopf, *Nature* **406**, 1039 (2000).
- 17) ***“Observation of Photon-Assisted Noise in a Diffusive Normal Metal-Superconductor Junction,”***  
A.A. Kozhevnikov, R.J. Schoelkopf, and D.E. Prober, *Phys. Rev. Lett.* **84**, 3398 (2000).
- 18) ***“Shot Noise Measurements in Diffusive Normal Metal-Superconductor (N-S) Junctions,”***  
A.A. Kozhevnikov, R.J. Schoelkopf, L.E. Calvet, M.J. Rooks, and D.E. Prober, *J. Low Temp. Phys.* **118**, 671 (2000).
- 19) ***“RF Single Electron Transistor Readout Amplifiers for Superconducting Astronomical Detectors of X-ray to Sub-mm Wavelengths,”***  
T.R. Stevenson, A. Aassime, P. Delsing, R.J. Schoelkopf, K. Segall, and C.M. Stahle, *IEEE Trans. on Appl. Superconductivity* **11**, 692 (2000).
- 20) ***“The Radio Frequency Single Electron Transistor as a Read-Out Device for Qubits: Charge Sensitivity and Back-Action,”***  
A. Aassime, G. Johansson, G. Wendin, R.J. Schoelkopf, and P. Delsing, *Phys. Rev. Lett.* **86**, 3376 (2001).
- 21) ***“Radio-Frequency Single-Electron Transistor: Towards the Shot-Noise Limit,”***  
A. Aassime, D. Gunnarsson, K. Bladh, P. Delsing, and R.J. Schoelkopf, *Appl. Phys. Lett.* **79**, 4031 (2001).
- 22) ***“Multiplexing of Radio-Frequency Single Electron Transistors,”***  
T. R. Stevenson, F.A. Pellerano, C.M. Stahle, K. Aidala, and R.J. Schoelkopf, *Appl. Phys. Lett* **80**, 3012 (2002).
- 23) ***“A High-Performance Cryogenic Amplifier Based on an RF-SET,”***  
K. Segall, K.W. Lehnert, T.R. Stevenson, R.J. Schoelkopf, P. Wahlgren, A. Aassime, and P. Delsing, *Appl. Phys. Lett.* **81**, 4859 (2002).
- 24) ***“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).
- 25) ***“Qubits as Spectrometers of Quantum Noise”***  
R.J. Schoelkopf, A.A. Clerk, S.M. Girvin, K.W. Lehnert, and M.H. Devoret, cond-mat/0210247 and “Quantum Noise in Mesoscopic Systems,” Y.V. Nazarov (ed.), Kluwer Academic Publishers, Dordrecht, ISBN#1-4020-1239-X, April 2003.
- 26) ***“Quantum Fluctuations of Charge and the Polarizability of the Single-Electron Box”***  
K. W. Lehnert, B.A. Turek, K. Bladh, D. Gunnarsson, P. Delsing, and R.J. Schoelkopf, *Phys. Rev. Lett* **91**, 106801 (2003).
- 27) ***“Primary Electronic Thermometry Using the Shot Noise of a Tunnel Junction”***  
L.F. Spietz, K.W. Lehnert, I. Siddiqi, and R.J. Schoelkopf, *Science* **300**, 1929 (2003).
- 28) ***“Prospects for Cavity QED with Superconducting Circuits: an Architecture for Solid-State Quantum Computing,”***  
S.M. Girvin, A. Blais, R. Huang, A. Wallraff, and R.J. Schoelkopf, cond-mat/0310670 and Proceedings of the LXXIX Les Houches Summer School on Quantum Entanglement and Information Processing.

## Robert J. Schoelkopf

### Publications (cont.):

- 29) ***“Single-Electron Transistor Backaction on the Single-Electron Box”***  
B.A. Turek, K. W. Lehnert, D. Gunnarsson, K. Bladh, P. Delsing, and R.J. Schoelkopf,  
Phys. Rev. B. **71**, 193304 (2005).
- 30) ***“Microwave Oscillations of a Nanomagnet Driven by a Spin-Polarised Current,”***  
S. I. Kiselev, J. C. Sankey, I. N. Krivorotov, N. C. Emley, R. J. Schoelkopf, R. A. Buhrman, and  
D. C. Ralph, Nature **425**, 380 (2003).
- 31) ***“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,  
Journal of Applied Physics **95**, 1274 (2004).
- 32) ***“Direct Observation of Dynamical Switching Between Two Driven Oscillator States of a  
Josephson Junction,”***  
I. Siddiqi, R. Vijay, F. Pierre, C.M. Wilson, L. Frunzio, M. Metcalfe, C. Rigetti, R.J. Schoelkopf,  
M.H. Devoret, D. Vion, and D. Esteve, Phys. Rev. Lett. **94**, 027005 (2005).
- 33) ***“Photon-Mediated Thermal Relaxation of Electrons in Nanostructures,”***  
D.R. Schmidt, R.J. Schoelkopf, and A.N. Cleland, Phys. Rev. Lett. **93**, 045901 (2004).
- 34) ***“Noise and Measurement Backaction in Superconducting Circuits: Qubits as Spectrometers of  
Quantum Noise,”***  
R.J. Schoelkopf, A.A. Clerk, K.W. Lehnert, and M.H. Devoret, Proceedings of the SPIE:  
Noise and Information in Nanoelectronics, Sensors, and Standards 5115, pp. 356-376 (2003).
- 35) ***“Cavity Quantum Electrodynamics for Superconducting Electrical Circuits: an Architecture  
for Quantum Computation,”***  
Alexandre Blais, Ren-Shou Huang, Andreas Wallraff, S.M. Girvin, and R.J. Schoelkopf,  
Phys. Rev. A **69**, 062320 (2004).
- 36) ***“Cryogenics on a Chip,”***  
J. Pekola, R. Schoelkopf, and J. Ullom, Physics Today, May 2004, 41 (2004).
- 37) ***“Coherent Coupling of a Single Photon to a Superconducting Qubit Using Circuit Quantum  
Electrodynamics”***  
A. Wallraff, D. Schuster, Alexandre Blais, L. Frunzio, Ren-Shou Huang, J. Majer, S. Kumar, S.M.  
Girvin, and R.J. Schoelkopf, Nature **431**, 162 (2004).
- 38) ***“AC Stark Shift and Dephasing in a Superconducting Qubit Strongly Coupled to a Cavity  
Field,”***  
D.I. Schuster, A. Wallraff, Alexandre Blais, L. Frunzio, Ren-Shou Huang, J. Majer, S.M. Girvin,  
and R.J. Schoelkopf, Phys. Rev. Lett. **94**, 123602 (2005).
- 39) ***“Backaction Effects of an SSET Measuring a Qubit: Spectroscopy and Ground State  
Measurements”***  
B. Turek, H. Majer, A. Clerk, S.M. Girvin, A. Wallraff, K. Bladh, D. Gunnarson, T. Duty, P.  
Delsing, and R.J. Schoelkopf, IEEE Trans. on Appl. Superconductivity **15**, 880 (2005).
- 40) ***“Fabrication and Characterization of Superconducting Circuit QED Devices for Quantum  
Computation,”***  
L. Frunzio, A. Wallraff, D. Schuster, J. Majer, and R.J. Schoelkopf, IEEE Trans. on Applied  
Superconductivity **15**, 860 (2005).
- 41) ***“Approaching Unit Visibility for Control of a Superconducting Qubit with Dispersive  
Readout,”***  
A. Wallraff, D.I. Schuster, A. Blais, L. Frunzio, J. Majer, M.H. Devoret, S.M. Girvin,  
and R.J. Schoelkopf, Phys. Rev. Lett. **95**, 060501 (2005).

## Robert J. Schoelkopf

### Publications (cont.):

- 42) ***“Dispersive Measurements of Superconducting Qubit Coherence with a Fast Latching Readout,”***  
I. Siddiqi, R. Vijay, M. Metcalfe, E. Boaknin, L. Frunzio, R.J. Schoelkopf, and M.H. Devoret, Phys. Rev. B. **73**, 054510 (2006).
- 43) ***“Quasiparticle Dynamics and a New, High-resolution Readout of STJ Detectors,”***  
D.E. Prober, J.D. Teufel, L. Frunzio, C.M. Wilson, and R.J. Schoelkopf, Nuclear Instruments and Methods in Physics Research A **559**, 676 (2006).
- 44) ***“Qubit-Photon Interactions in a Cavity: Measurement Induced Dephasing and Number Splitting,”***  
J. Gambetta, A. Blais, D.I. Schuster, A. Wallraff, L. Frunzio, J. Majer, M.H. Devoret, S.M. Girvin, and R.J. Schoelkopf, Phys. Rev A **74**, 042318 (2006).
- 45) ***“Hybrid Quantum Processors: Molecular Ensembles as Quantum Memory for Solid State Circuits,”***  
P. Rabl, D. DeMille, John M. Doyle, M.D. Lukin, R.J. Schoelkopf, and P. Zoller, cond-mat/0604140 & Phys. Rev. Lett. **97**, 033003 (2006).
- 46) ***“Polar Molecules Near Superconducting Resonators: A Coherent, All-electrical, Molecule-Mesoscopic Interface,”***  
A. Andre, D. DeMille, J.M. Doyle, M.D. Lukin, S.E. Maxwell, P. Rabl, R.J. Schoelkopf, and P. Zoller, quant-ph/0605201 & Nature Physics **2**, 636 (2006).
- 47) ***“Resolving Single Photon States in a Superconducting Circuit,”***  
D.I. Schuster, A.A. Houck, J.A. Schreier, A. Wallraff, J.M. Gambetta, A. Blais, L. Frunzio, J. Majer, B. Johnson, M.H. Devoret, S.M. Girvin, and R.J. Schoelkopf, Nature **445**, 515 (2007).
- 48) ***“Hybrid Quantum Information Processing with Polar Molecules,”***  
A. Andre, D. DeMille, J.M. Doyle, M.D. Lukin, S.E. Maxwell, P. Rabl, R.J. Schoelkopf, and P. Zoller, Proceedings of the 20<sup>th</sup> International Congress on Atomic Physics, ICAP 2006, in press.
- 49) ***“Shot Noise Thermometry Down to 10 mK,”***  
L. Spietz, P. Pari, and R.J. Schoelkopf, Applied Physics Letters, **89**, 183123 (2006).
- 50) ***“Generating Single Microwave Photons in a Circuit,”***  
A.A. Houck, D.I. Schuster, J.M. Gambetta, J.A. Schreier, B.R. Johnson, J.M. Chow, J. Majer, L. Frunzio, M.H. Devoret, S.M. Girvin, and R.J. Schoelkopf, cond-mat/0702648 and Nature **449**, 328 (2007).
- 51) ***“Charge Insensitive Qubit Design Derived from the Cooper-Pair Box,”***  
Jens Koch, T.M. Yu, J.M. Gambetta, A.A. Houck, D.I. Schuster, J. Majer, A. Blais, M.H. Devoret, S.M. Girvin, and R.J. Schoelkopf, cond-mat/0703002 (2007) and Phys Rev A **76**, 042319 (2007).
- 52) ***“Sideband Transitions and Two-Tone Spectroscopy of a Superconducting Qubit Strongly Coupled to an On-Chip Cavity,”***  
A. Wallraff, D.I. Schuster, A. Blais, J.M. Gambetta, J. Schreier, A. Houck, L. Frunzio, M.H. Devoret, S.M. Girvin, and R.J. Schoelkopf, Phys. Rev. Lett. **99**, 050501 (2007).
- 53) ***“Observing Single-Electron Tunneling Events in an Electron Trap,”***  
J.H. Love, A. Clerk, M.H. Devoret, and R.J. Schoelkopf, in preparation (2007).
- 54) ***“Protocols for Optimal Readout of Qubits Using a Continuous Quantum Nondemolition Measurement,”***  
J. Gambetta, W.A. Braff, A. Wallraff, S.M. Girvin, and R.J. Schoelkopf, Phys. Rev A **76**, 012325 (2007).

## Robert J. Schoelkopf

### Publications (cont.):

- 55) ***“Quantum Information Processing with Circuit Quantum Electrodynamics,”***  
A. Blais, J. Gambetta, A. Wallraff, D.I. Schuster, S.M. Girvin, M.H. Devoret, and R.J. Schoelkopf, cond-mat/0612038 and Phys. Rev A **75**, 032329 (2007).
- 56) ***“Coupling Superconducting Qubits via a Cavity Bus,”***  
J. Majer, J.M. Chow, J. Gambetta, J. Koch, B.R. Johnson, J.A. Schreier, L. Frunzio, D.I. Schuster, A.A. Houck, A. Blais, A. Wallraff, S.M. Girvin, M.H. Devoret, and R.J. Schoelkopf, cond-mat/07092135 and Nature **449**, 443 (2007).
- 57) ***“Circuit QED: How Strong Can the Coupling Between a Josephson Junction Atom and a Transmission Line Resonator Be?,”***  
M.H. Devoret, S.M. Girvin, and R.J. Schoelkopf, Ann. Phys. **16**, 767 (2007).
- 58) ***“Measuring the Decoherence of a Quntronium Qubit with the Cavity Bifurcation Amplifier,”***  
M. Metcalfe, E. Boaknin, V. Manucharyan, R. Vijay, I. Siddiqi, C. Rigetti, L. Frunzio, R.J. Schoelkopf, and M.H. Devoret, Phys. Rev. B **76**, 174516 (2007).
- 59) ***“Observation of Berry’s Phase in a Solid-State Qubit,”***  
P.J. Leek, J.M. Fink, A. Blais, R. Bianchetti, M. Goppl, J.M. Gambetta, D.I. Schuster, L. Frunzio, R.J. Schoelkopf, and A. Wallraff, Science **318**, 1889 (2007).
- 60) ***“Ultrasensitive Quantum-Limited Far-Infrared STJ Detectors,”***  
D.E. Prober, J.D. Teufel, C.M. Wilson, L. Frunzio, M. Shen, R.J. Schoelkopf, T.R. Stevenson, and E.J. Wollack, IEEE Trans. On Applied Supercond. **17**, 241 (2007).
- 61) ***“Wiring Up Quantum Systems,”***  
R.J. Schoelkopf and S.M. Girvin, Nature **451**, 664 (2008).
- 62) ***“Suppressing Charge Noise Decoherence in Superconducting Charge Qubits,”***  
J.A. Schreier, A.A. Houck, Jens Koch, D.I. Schuster, B.R. Johnson, J.M. Chow, J.M. Gambetta, J. Majer, L. Frunzio, M.H. Devoret, S.M. Girvin, and R.J. Schoelkopf, cond-mat/07123581 and Phys. Rev. B., in press (2008).
- 63) ***“Controlling the Spontaneous Emission of a Superconducting Transmon Qubit,”***  
A.A. Houck, J.A. Schreier, B.R. Johnson, J.M. Chow, Jens Koch, J.M. Gambetta, D.I. Schuster, L. Frunzio, M.H. Devoret, S.M. Girvin, and R.J. Schoelkopf, cond-mat/08034490 and submitted to Phys. Rev. Lett., 2008.

## Robert J. Schoelkopf

### Invited Talks:

**“How I Learned to Stop Worrying About  $1/f$  Noise and Love the Charge Qubit,”**

Workshop on Decoherence in Superconducting Qubits, Berkeley CA, 12/07.

**“Quantum Optics and Quantum Computing with Superconducting Circuits,”**

Workshop on Nanoelectronics, Canadian Institute For Advancement of Research, Vancouver, Canada 11/07.

**“Circuit QED: Quantum Optics on a Superconducting Chip,”**

Invited talk at Rochester Conference on Quantum Optics (CQO9), 6/07

**“Quantum Optics and Quantum Computing with Superconducting Circuits,”**

Symposium on 50<sup>th</sup> Anniversary of the BCS Theory of Superconductivity, Brown University, 4/07.

**“Circuit QED: Quantum Optics on a Superconducting Chip,”**

Invited seminar at College de France, Paris, 12/06.

**“QND Measurements of Qubits and Photons,”**

WE-Heraeus-Seminar on “Strong Coupling of Light and Matter,” Bad Honnef, Germany, 9/06.

**“Circuit QED and the Prospects for Quantum Circuits with Polar Molecules,”**

20<sup>th</sup> International Conference on Atomic Physics, Innsbruck, Austria, 7/06

**“QND Measurements of Qubits and Photons,”**

Macroscopic Quantum Coherence and Computing MQC2 2006, Naples, Italy, 6/06

**“Circuit QED and the Prospects for Quantum Circuits with Polar Molecules,”**

Gordon Conference on Quantum Information Processing, Il Ciocco, Italy, 5/06

**“Cavity QED with Polar Molecules?”**

DoD Workshop on Quantum Computing with Polar Molecules, Washington, DC, 9/05

**“Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip,”**

Gordon Conference on Atomic, Molecular, and Optical Physics, Tilton, NH 6/05.

APS Division of Atomic, Molecular, and Optical Physics Annual Meeting,

Lincoln, NE, 5/05.

Gordon Conference on Quantum Information Science, Ventura, CA, 3/05.

Southwest Quantum Information Network Annual Meeting, Tucson, AZ, 2/05.

Frontiers in Nanoscale Science and Technology Workshop, Harvard University, 10/04.

**“Experiments in Cavity QED with Superconducting Circuits,”**

International Workshop on Mesoscopic Physics, Quantum Optics, and Quantum Information, ITAMP/Harvard University, May 2004.

**“Continuous Measurements of Superconducting Qubits,”**

International Conference on Solid-State Quantum Information Processing, Amsterdam, the Netherlands, December 2003. (plenary talk)

**“Superconducting Charge Qubits and the Prospects for Strong Cavity QED,”**

Summer School: Quantum Entanglement and Information, Les Houches, France, July 2003.

Gordon Research Conference on Quantum Information, Ventura, CA, March 2003.

AFOSR Program Review on Superconducting Quantum Computing, NY, May 2003.

**“Qubits as Spectrometers of Quantum Noise,”**

SPIE Conference on Fluctuations and Noise, Santa Fe, NM, June 2003.

- “Measuring Single Charges,”** Workshop on Quantum Information in Group IV Semiconductors, Oxnard, CA March 2003.
- “Measuring Quantum Coherence in the Single Cooper-Pair Box,”**  
Int’l Symposium on Mesoscopic Superconductivity and Spintronics, NTT Laboratories, Hon-Atsugi, Japan, Mar 4-6, 2002.
- Presentation and discussion leader,** AFOSR Workshop on Superconducting Quantum Computing, Virginia Beach, VA, Mar 24-27, 2002.
- “The Cooper-pair Box as a Quantum Spectrum Analyzer,”** NATO/ASI Workshop on Quantum Noise in Mesoscopic Systems, Delft, the Netherlands, June 2-4, 2002.
- “Quantum Coherence in Single-Charge Electronics: Engineering and Measuring a Single Spin,”** Gordon Research Conference on Correlated Electron Systems, Waterville, ME, June 29-Aug 3, 2002
- “Superconducting Single-Photon Detectors for Submillimeter Astronomy”**  
SPIE Conference on Astronomical Telescopes and Detectors, Kona, HI, Aug 25-28, 2002.
- “Quantum Control and Measurement of Artificial Atoms *or* Engineering Quantum Circuits for Fun, Physics, and Technology”**  
Meeting of 2001 Packard Fellows, Monterey, CA.
- “Fast Electrometry of Coherent Macroscopic States in the Cooper-pair Box,”**  
ITP Workshop on Nanoscience, Santa Barbara, CA, Aug., 2001.
- “Single Electron Transistor Readouts for UV thru Sub-mm Single-Photon Counting Detectors,”**  
9th International Workshop on Low Temperature Detectors, Madison, WI, July 2001.
- “Probing the Dynamics of Single-Charge Circuits with Fast Electrometry,”**  
Applied Superconductivity Conference 2000, Virginia Beach, Sept. 2000  
International Workshop on Mesoscopic Electronics, Ascona, Switzerland, Oct. 2000  
XXXVIth Rencontres de Moriond, Savoie, France, Jan 2001.
- “Far-Infrared Photon-counting Detectors,”**  
NASA Workshop on Space Astrophysics Detector Development, STScI, Baltimore, MD, June 2000.
- “A Fast Coulomb-Blockade Electrometer: Toward Single-Charge Dynamics,”**  
NEDO Workshop on Andreev Physics and Single Charge Tunelling, Gothenburg, Sweden, April 1998;  
LT-22 Conference, Helsinki, Finland, Aug. 1999;  
XXXIV Recontres de Moriond, “Quantum Physics at the Mesoscopic Scale,” Les Arcs, France, Jan. 1999.
- “Frequency-Dependent Noise in Mesoscopic Conductors,”**  
American Physical Society March Meeting, Los Angeles, 1998.
- “Diffusion-Cooled Hot-Electron Bolometers,”**  
Proceedings of the International Superconducting Electronics Conference ‘97, Berlin, June, 1997.

## Robert J. Schoelkopf

### Seminars/Colloquia:

#### **“Circuit QED: Quantum Optics on a Superconducting Chip,”**

Physics/EE Colloquium, University of New South Wales, Sydney, Australia, 4/08  
Seminar, Physics Department, University of Queensland, Brisbane, Australia, 4/08  
Physics Colloquium, University of Melbourne, Melbourne, Australia, 5/08  
Physics/Chancellor’s Colloquium, Macquarie University, Sydney, Australia 5/08

#### **“Quantum Noise and Measurement,”**

A four lecture mini-course, Centre for Quantum Computing Technology, University of New South Wales, Australia, 4/08.

#### **“Circuit QED: Quantum Optics on a Superconducting Chip,”**

Colloquium, Waterloo University, Montreal, Canada, 3/07.

#### **“Cavity QED with Superconducting Resonators,”**

Workshop on Physics and Applications of Superconducting Microresonators, California Institute of Technology, 3/07.

#### **“Circuit QED: Quantum Optics on a Superconducting Chip,”**

Colloquium, McGill University, Montreal, Canada, 1/07.  
Colloquium, California Institute of Technology, 11/06.

#### **“Circuit QED: QND Measurements of Superconducting Qubits and Single Photons,”**

Ecole Normale Superieure, Paris, France 5/06, CEA/Saclay Condensed Matter Seminar, 5/06.

#### **“Kondo Physics and the Lamb Shift in the Single-Electron Box,”**

Solid-State Seminar, University of Minnesota, 2/06.

#### **“Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip”**

Colloquium, University of Minnesota, 2/06  
Colloquium, SUNY Stonybrook, 1/06  
Colloquium, Amherst College, 11/05  
Colloquium, Harvard University, 4/05  
Quantum Information Seminar, MIT 12/04  
Colloquium, New York University 11/04, Yale University 11/04  
Seminar, Rutgers 9/04, Michigan State 11/04

#### **“Experiments in Cavity QED with Superconducting Circuits,”**

Seminar, Cornell 4/04, Princeton 4/04, CEA/Saclay, Paris, France 5/04, Ecole Normale Superieure, Paris, France 5/04, Laboratory for Physical Sciences/NSA 7/04.

#### **“Kondo Physics and the Lamb Shift in the Single-Electron Box,”**

Solid-State Seminar, Caltech, 4/03, Yale 5/03.

#### **“The Ideal Electron Gas Thermometer,”**

Seminar, NIST Temperature Metrology Group, Gaithersburg, MD, 1/03.

#### **“Measuring Quantum Coherence in the Single Cooper-Pair Box,”**

Solid-State Seminar, UMass/Amherst, 10/02.  
Solid-State Seminar, SUNY Stonybrook, 12/01.  
Physics Colloquium, Yale University, 11/01,

#### **“Probing the Dynamics of Single-Charge Circuits with Fast Electrometry,”**

Physics Colloquium, Caltech 10/99.  
Seminar, Qnantronics Group, Saclay/CEA 10/00.

**“Superconducting Single-Photon Detectors for Submillimeter Waves,”**

Cosmology/Gravity Group Seminar, Princeton University, 10/99.

**“The RF-SET: a Fast and Ultrasensitive Quantum Electrometer,”**

Solid-State Seminars at: Caltech, MIT, Berkeley, Michigan, Oregon, Florida, Northeastern, Virginia, Dartmouth, NASA/Goddard Space Flight Center, Lab for Physical Sciences/NSA; 1998.

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### **Public Outreach Lectures and Activities:**

#### **“Circuit QED: Atoms and Cavities in Superconducting Circuits,”**

Tutorial in session on solid-state cavity QED, APS March Meeting, Baltimore, 3/06.

#### **“Quantum Noise and Measurement,”**

4 lecture series at Boulder Summer School on Mesoscopic Physics, Boulder, CO 7/05

#### **“Quantum Optics and Quantum Computing with Superconducting Circuits,”**

talk for Annual Spring Meeting of JASON, Washington, DC 4/05.

#### **“Quantum Computing with Superconducting Circuits,”** talk for Yale Society of Physics Students, 4/4/03.

#### **“Single-Electronics: Circuits to Control and Measure Electrons One-by-One,”**

Yale Science Forum, New Haven, CT, April 2001.

#### **“Single Electron Devices,”** talk for Yale Society of Physics Students, 4/14/00.

#### **“The Small and the Cold: Nanoscale Electronics,”** lecture in “Frontiers of Science and Engineering,” a Saturday program for high-school juniors, 3/25/00.

#### **“The Coldest Place in Connecticut,”** Tours and demos for Yale’s Tercentennial Open House, on October 21, 2000.

#### **“Single Electronics,”** Perspectives on Science lecture for Yale freshman interested in majoring in science, October 1998.

### **Student and Alumni Awards:**

Andreas Wallraff (postdoctoral associate, now assistant professor at ETH Zurich) – the 2006 Nicholas Kurti European Science Prize.

Lafe Spietz (Yale PhD 2006) – the Henry Prentiss Becton Prize for best engineering dissertation of the year at Yale, for “The Shot Noise Thermometer.”

David I Schuster (Yale PhD 2007; “Circuit Quantum Electrodynamics”) – Northeastern Association of Graduate Schools (NAGS) Award for Best Doctoral Dissertation in Physical Sciences, Mathematics, or Engineering, 2007.