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PERSONAL

U.S. Citizen. Married, two children.

EDUCATION

Princeton University, A. B. Physics, cum laude.	1986
California Institute of Technology, Ph.D., Physics.	1995

ACADEMIC APPOINTMENTS

Director of Yale Quantum Institute	2014 – present
Sterling Professor of Applied Physics and Physics, Yale University	2013- present
William A. Norton Professor of Applied Physics and Physics, Yale University	2009-2013
Co-Director of Yale Center for Microelectronic Materials and Structures	2006-2012
Associate Director, Yale Institute for Nanoscience and Quantum Engineering	2009
Professor of Applied Physics and Physics, Yale University	2003-2008
Interim Department Chairman, Applied Physics, Yale University	July-December 2012
Visiting Professor, University of New South Wales, Australia	March-June 2008
Assistant Professor of Applied Physics and Physics, Yale University	July 1998-July 2003
Associate Research Scientist and Lecturer, Department of Applied Physics, Yale University	January 1995-July 1998
Graduate Research Assistant, Physics, California Institute of Technology	1988-1994
Electrical/Cryogenic Engineer, Laboratory for High-Energy Astrophysics, NASA/Goddard Space Flight Center	1986-1988

HONORS AND AWARDS

Connecticut Medal of Science (The Connecticut Academy of Science and Engineering)	2017
Elected to American Academy of Arts and Sciences	2016
Elected to National Academy of Sciences	2015
Max Planck Forschungspreis	2014
Fritz London Memorial Prize	2014
John Stewart Bell Prize	2013
Yale Science and Engineering Association (YSEA) Award for Advancement of Basic and Applied Science	2010
Member of Connecticut Academy of Science and Engineering	2009
APS Joseph F. Keithley Award for Advances in Measurement Science	2009
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 Lucile Packard Foundation Fellow	2000-2005

CURRENT GRADUATE STUDENTS

Jacob Curtis	(2017 - present)
Stijn de Graaf	(2018 – present)
Yanni Dahmani	(2021 – present)
Suhas Ganjam	(2017 - present)
John Garmon	(2021 - present)
William Kalfus	(2020 – present)
Aniket Maiti	(2018 – present)
Alex Read	(2018 – present)
James Teoh	(2017 - present)
Neel Thakur	(2020 – present)
Yanhao Wang	(2021 – present)
Taekwan Yoon	(2016 - present)
Sophia Xue	(2020 – present)

GRADUATE STUDENTS SUPERVISED

Lev Krayzman	(*Ph.D. – 2022; Postdoctoral Associate, Princeton University*)
Christopher Wang	(*Ph.D. – 2022; Postdoctoral Associate, University of Chicago*)
Sal Elder	(*M.S. – 2021; Quantitative Strategist, Susquehanna International Group, LLP*)
Luke Burkhart	(*Ph.D. – 2020*; *Research Staff at Keysight Technologies*)
Philip Reinhold	(*Ph.D. - 2019; Quantum Research Scientist, AWS*)
Christopher Axline	(*Ph.D. - 2018*; *Research Scientist, ETH-Eidgenössische Technische Hochschule Zürich)*
Yvonne Gao	(*Ph.D.- 2018; Assistant Professor, National University, Singapore*)
Kevin Chou	*(Ph.D. - 2018; Quantum Engineer, Quantum Circuits, Inc.)*
Jacob Blumoff	*(Ph.D. - 2017; Research Staff, HRL Laboratories)*
Teresa Brecht	*(Ph.D. - 2017; Research Staff, HRL Laboratories)*
Andrei Petrenko	*(Ph.D. - 2015; Director of Product, Quantum Circuits, Inc.)*
Matthew Reagor	*(Ph.D. - 2015; Director at Rigetti Computing)*
Eric Holland	*(Ph.D. – 2015; Research Staff at Lawrence Livermore National Lab)*
Brian Vlastakis	*(Ph.D. – 2015; Postdoctoral Research Assistant, Oxford University)*
Andreas Fragner	*(Ph.D. – 2013; Quantitative Analyst, Oxford Asset Management)*
Matthew Reed	*(Ph.D. – 2013; Senior Research Scientist at HRL Laboratories)*
Adam Sears	*(Ph.D. – 2013; Research Staff Texas A&M Health Center)*
Blake Johnson	*(Ph.D. – 2011; Research Staff at IBMQ)*
Jerry M. Chow	*(Ph.D. – 2010; Director at IBM Watson)*
John Teufel	*(Ph.D. – 2008), Research Staff at NIST/Boulder)*
David Schuster	*(Ph.D. – 2007; Faculty at Stanford University)*
Julie Wyatt-Love	*(Ph.D. – 2007; Senior Director, Quantum Business Dev at Microsoft)*
Benjamin Turek	*(Ph.D. – 2007; Research Staff at John Hopkins APL)*
Minghao Shen	*(Ph.D. – 2005; Advanced Micro Devices, Inc.)*
Lafe Spietz	*(Ph.D. – 2001)*

UNDERGRADUATE STUDENTS SUPERVISED

Katherine Aidala	Faculty at Mount Holyoke College, MA
Will Braff	
Spencer DeSanto	

Alex Deters	
Benjamin Jarvis	
Sameer Kumar	
Molly Silfen	
Jared Schwede	Co-founder of Spark Thermionics, CA
Max Ventilla	
Shunjiang Xu	

CURRENT POSTDOCTORAL ADVISEES

Archan Banerjee	Yao Lu
Takahiro Tsunoda	Patrick Winkel

PAST POSTDOCTORAL ADVISEES

Benjamin Chapman	*Microsoft*
Yiwen Chu	*Faculty at ETH Zurich, Switzerland*
Nathanael Cottet	*Alice & Bob, France*
Leonardo DiCarlo	*Faculty at Delft University of Technology*
Christa Flühmann	*Hamilton Bonaduz AG, Switzerland*
Luigi Frunzio	*Senior Research Scientist, Applied Physics, Yale University*
Reinier Heeres	*Engineer, Cooll, Netherlands*
Andrew Houck	*Faculty at Princeton University*
Vijay Jain	*Psi Quantum, Palo Alto*
Gerhard Kirchmair	*Faculty at University of Innsbruck*
Konrad Lehnert	*JILA, Univ of Colorado*
Chan U Lei	*Quantum Circuits, Inc., CT*
Brian Lester	*Senior Quantum Engineer, Atom Computing, California*
Johannes Majer	*Staff at Atominstitut, TU Vienna*
Nissim Ofek	*VP R&D, Quantum Machines*
Hanhee Paik	*Research Staff at IBM Watson*
Wolfgang Pfaff	*Faculty at the University of Illinois at Urbana-Champaign*
Serge Rosenblum	*Faculty at the Weizmann Institute of Science*
Ken Segall	*Faculty at Colgate University*
David Schuster	*Faculty at Stanford University*
Irfan Siddiqi	*Faculty at UC Berkeley*
Luyan Sun	*Faculty at Tsinghua University*
Andreas Wallraff	*Faculty at ETH Zurich, Switzerland*
Chen Wang	*Faculty at University of Massachusetts Amherst*
Yaxing Zhang	*Google, Inc.*

ADVISORS

Thomas G. Phillips	*John D. MacArthur Professor of Physics, Emeritus, California Institute of Technology (CALTECH)*
Daniel E. Prober	*Professor of Applied Physics, of Electrical Engineering and of Physics*
Jonas Zmuidzinas	*Merle Kingsley Professor of Physics; Chief Technologist, Jet Propulsion Laboratory, Division of Physics, Mathematics and Astronomy*

PEER REVIEWED PUBLICATIONS

181) L. Burkhart, R. Schoelkopf, et al., "Remote entanglement in the microwave domain: a review of strategies and fundamental limits". In preparation.

180) Benjamin J. Chapman, Stijn J. de Graaf, Sophia H. Xue, Yaxing Zhang, James Teoh, Jacob C. Curtis, Takahiro Tsunoda, Alec Eickbusch, Alexander P. Read, Akshay Koottandavida, Shantanu O. Mundhada, Luigi Frunzio, M. H. Devoret, S. M. Girvin, R. J. Schoelkopf, "A high on-off ratio beamsplitter interaction for gates on bosonically encoded qubits". [arXiv:2212.11929]

179) James D. Teoh, Patrick Winkel, Harshvardhan K. Babla, Benjamin J. Chapman, Jahan Claes, Stijn J. de Graaf, John W.O. Garmon, William D. Kalfus, Yao Lu, Aniket Maiti, Kaavya Sahay, Neel Thakur, Takahiro Tsunoda, Sophia H. Xue, Luigi Frunzio, Steven M. Girvin, Shruti Puri, Robert J. Schoelkopf, "Dual-rail encoding with superconducting cavities". [arXiv:2212.12077]

178) Takahiro Tsunoda, James D. Teoh, William D. Kalfus, Stijn J. de Graaf, Benjamin J. Chapman, Jacob C. Curtis, Neel Thakur, Steven M. Girvin, and Robert J. Schoelkopf, "Error-detectable bosonic entangling gates with a noisy ancilla". [arXiv:2212.11196]

177) V. V. Sivak, A. Eickbusch, B. Royer, S. Singh, I. Tsioutsios, S. Ganjam, A. Miano, B. L. Brock, A. Z. Ding, L. Frunzio, S. M. Girvin, R. J. Schoelkopf, and M. H. Devoret, "Real-time quantum error correction beyond break-even". [arXiv:2211.09116]

177) V Jain, VD Kurilovich, YD Dahmani, CU Lei, D Mason, T Yoon, PT Rakich, L. I. Glazman, and R. J. Schoelkopf, "Acoustic radiation from a superconducting qubit: From spontaneous emission to Rabi oscillations". [arXiv:2211.07475]

176) Nicholas E. Frattini, Rodrigo G. Cortiñas, Jayameenakshi Venkatraman, Xu Xiao, Qile Su, Chan U Lei, Benjamin J. Chapman, Vidul R. Joshi, S. M. Girvin, Robert J. Schoelkopf, Shruti Puri, Michel H. Devoret, "The squeezed Kerr oscillator: spectral kissing and phase-flip robustness". [arXiv:2209.03934]

175) Taekwan Yoon, David Mason, Vijay Jain, Yiwen Chu, Prashanta Kharel, William H. Renninger, Liam Collins, Luigi Frunzio, Robert J Schoelkopf, Peter T Rakich, "Simultaneous Brillouin and piezoelectric coupling to high-frequency bulk acoustic resonator". [arXiv:2208.06454]

174) Alexander P. Read, Benjamin J. Chapman, Chan U Lei, Jacob C. Curtis, Suhas Ganjam, Lev Krayzman, Luigi Frunzio, and Robert J. Schoelkopf, "Precision measurement of the microwave dielectric loss of sapphire in the quantum regime with parts-per-billion sensitivity," [arXiv:2206.14334]

173 Christopher S. Wang, Nicholas E. Frattini, Benjamin J. Chapman, Shruti Puri, S. M. Girvin, Michel H. Devoret, and Robert J. Schoelkopf. "Observation of wave-packet branching through an engineered conical intersection". [arxiv:2202.02364]

172) G. Catelani, K. Li, C. J. Axline, T. Brecht, L. Frunzio, R. J. Schoelkopf, and L.I. Glazman, "Ac losses in field-cooled type I superconducting cavities," *Supercond. Sci. Technol*. **35**, 065016 (2022). DOI: 10.1088/1361-6668/ac636d

171) Alec Eickbusch, Volodymyr Sivak, Andy Z. Ding, Salvatore S. Elder, Shantanu R. Jha, Jayameenakshi Venkatraman, Baptiste Royer, S.M. Girvin, Robert J. Schoelkopf, and Michel H. Devoret, "Fast Universal Control of an Oscillator with Weak Dispersive Coupling to a Qubit," *Nat. Phys.* (2022). DOI:10.1038/s41567-022-01776-9

170) Yaxing Zhang, Jacob C. Curtis, Christopher S. Wang, R.J. Schoelkopf, S. M. Girvin, "Drive-induced nonlinearities of cavity modes coupled to a transmon ancilla," *Phys. Rev. A* **105**, 022423 (2022). DOI:10.1103/PhysRevA.105.022423.

169) L. Burkhart, J. Teoh, Y. Zhang, C. Axline, L. Frunzio, M. H. Devoret, L. Jiang, S. Girvin, R. J. Schoelkopf. "Error-detected state transfer and entanglement in a superconducting quantum network," *PRX Quantum* **2**, 030321 (2021). DOI: 10.1103/PRXQuantum.2.030321.

168) W.-L. Ma, S. Puri, R. J. Schoelkopf, M. Devoret, S. M. Girvin, and L. Jiang, "Quantum control of bosonic modes with superconducting circuits," *Science Bulletin* **66**, 1789-1805 (2021). DOI: 10.1016/j.scib.2021.05.024

167) Jacob C. Curtis, Connor T. Hann, Salvatore S. Elder, C.S. Wang, Luigi Frunzio, Liang Jiang, and Robert J. Schoelkopf, "Single-shot number-resolved detection of microwave photons with error mitigation," Phys. Rev. A **103**, 023705 (2020). DOI:10.1103/PhysRevA.103.023705.

166) P. Campagne-Ibarcq, A. Eickbusch, S. Touzard, E. Zalys-Geller, N.E. Frattini, V. V. Sivak, P. Reinhold, S. Puri, S. Shankar, R.J. Schoelkopf, L. Frunzio, M. Mirrahimi, M.H. Devoret, "Quantum error correction of a qubit encoded in grid states of an oscillator," *Nature* **584**, 368-372. (2020). DOI:10.1038/s41586-020-2603-3.

165) W.-L. Ma, M. Zhang, Y. Wong, K. Noh, S. Rosenblum, P. Reinhold, R. J. Schoelkopf, and L. Jiang, "Path-Independent Quantum Gates with Noisy Ancilla," *Phys. Rev. Lett.* **125**, 110503 (2020). DOI: 10.1103/PhysRevLett.125.110503.

164) P. Reinhold, S. Rosenblum, W.-L. Ma, L. Frunzio, L. Jiang, R. J. Schoelkopf, "Error-corrected gates on an encoded qubit," *Nat. Phys.* **16,** 822–826. (2020). DOI:10.1038/s41567-020-0931-8.

163) C. Wang, J. Curtis, B. Lester, Y. Zhang, Y. Gao, J. Freeze, V. Batista, P. Vaccaro, I. Chuang, L. Frunzio, L. Jiang, S. Girvin, R. Schoelkopf. "Efficient Multiphoton Sampling of molecular vibronic spectra on a superconducting bosonic processor," *Phys. Rev. X* **10**, 021060 (2020). DOI:10.1103/PhysRevX.10.021060.

162) I. Tsioutsios, K. Serniak, S. Diamond, Z. Wang, S. Shankar, L. Frunzio, R. J. Schoelkopf, M. H. Devoret, "Free-standing silicon shadow masks for transmon qubit fabrication*," AIP Advances* **10**, 065120 (2020). DOI:10.1063/1.5138953.

161) C.U. Lei, L. Krayzman, S. Ganjam, L. Frunzio, R. Schoelkopf. "High coherence superconducting microwave cavities with indium bump bonding," *Applied Physics Letters* 1**16**, 15, 154002 (2020). DOI:10.1063/5.0003907.

160) C. T. Hann, C.-L. Zou, Y. Zhang, Y. Chu, R. J. Schoelkopf, S. M. Girvin, L. Jiang, "Hardware-efficient quantum random access memory with hybrid quantum acoustic systems," *Phys. Rev. Lett*. **123**, 250501 (2020). DOI:10.1103/PhysRevLett.123.250501.

159) S. S. Elder, C. S. Wang, P. Reinhold, C. T. Hann, K. S. Chou, B. J. Lester, S. Rosenblum, L. Frunzio, L. Jiang, and R. J. Schoelkopf, "High-fidelity measurement of qubits encoded in multilevel superconducting circuits," *Phys. Rev. X* **10**, 011001 (2020). DOI: 10.1103/PhysRevX.10.011001.

158) K. Serniak, S. Diamond, M. Hays, V. Fatemi, S. Shankar, L. Frunzio, R. J. Schoelkopf, and M. H. Devoret, "Direct Dispersive Monitoring of Charge Parity in Offset-Charge-Sensitive Transmons," *Phys. Rev. Applied* **12**, 014052 (2019). DOI:10.1103/PhysRevApplied.12.014052.

157) Z. K. Minev, S.O. Mundhada, S. Shankar, P. Reinhold, R. Gutierrez-Jauregui, R.J. Schoelkopf, M. Mirrahimi, H.J. Carmichael, M.H. Devoret, "To catch and reverse a quantum jump mid-flight," *Nature* **570**, 200-204 (2019). DOI:10.1038/s41586-019-1287-z.

156) Y. Y. Gao, B. J. Lester, K. Chou, L. Frunzio, M. H. Devoret, L. Jiang, S. M. Girvin, R.J. Schoelkopf, "Entanglement of Bosonic Modes through an Engineered Exchange Interaction," *Nature* **566**, 509–512 (2019). DOI:10.1038/s41586-019-0970-4

155) Y. Zhang, B. Lester, Y. Gao, L. Jiang, R. Schoelkopf, S. Girvin, "Engineering bilinear mode coupling in circuit QED: theory and experiment," *Physical Review A* **99**, 012314 (2019). DOI:10.1103/PhysRevA.99.012314.

154) P. Kharel, Y. Chu, M. Power, W. H. Renninger, R.J. Schoelkopf, P.T. Rakich, "Ultra-high-Q Phononic Resonators on-Chip at Cryogenic Temperature," *APL Photonics* **3**, 066101 (2018). DOI:10.1063/1.5026798.

153) Y. Chu, P. Kharel, T. Yoon, L. Frunzio, P. T. Rakich, R. J. Schoelkopf, "Creation and control of multi-phonon Fock states in a bulk acoustic-wave resonator," *Nature* **563**, 666-670 (2018). DOI:10.1038/s41586-018-0717-7.

152) C. Hann, S. Elder, C. Wang, K. Chou, R. Schoelkopf, L. Jiang, "Robust readout of bosonic qubits in the dispersive coupling regime," *Physical Review A* **98**, 022305 (2018). DOI:10.1103/PhysRevA.98.022305.

151) S. Rosenblum, P. Reinhold, M. Mirrahimi, L. Jiang, L. Frunzio, R.J. Schoelkopf, "Fault-tolerant measurement of a quantum error," *Science* **361**, 6399, pp. 266-270 (2018). DOI:10.1126/science.aat3996.

150) K. S. Chou, J. Z. Blumoff, C.S. Wang, P.C. Reinhold, C. J. Axline, Y.Y. Gao, L. Frunzio, M.H. Devoret, L. Jiang, R. J. Schoelkopf, "Deterministic teleportation of a quantum gate between two logical qubits," *Nature* **561**, 368-373 (2018). DOI:10.1038/s41586-018-0470-y

149) Y. Y. Gao, B.J. Lester, Y. Zhang, C. Wang, S. Rosenblum, L. Frunzio, L. Jiang, S.M. Girvin, R.J. Schoelkopf, "Programmable interference between two microwave quantum memories," *Phys. Rev. X* **8**, 021073 (2018). DOI:10.1103/PhysRevX.8.021073.

148) C. Axline, L. Burkhart, W. Pfaff, M. Zhang, K. Chou, P. Campagne-Ibarqc, P. Reinhold, L. Frunzio, S. Girvin, L. Jiang, M. H. Devoret, R.J. Schoelkopf, "On-demand quantum state transfer and entanglement between remote microwave cavity memories," *Nature Physics* **14**, 705-710 (2018). DOI: 10.1038/s41567-018-0115-y

147) P. Campagne-Ibarcq, E. Zalys-Geller, A. Narla, S. Shankar, P. Reinhold, L. Burkhart,C. Axline, W. Pfaff, L. Frunzio, R.J. Schoelkopf, M.H. Devoret, "Deterministic remote entanglement of superconducting circuits through microwave two-photon transitions," *Phys. Rev. Lett.* **120**, 200501 (2018). DOI:10.1103/PhysRevLett.120.200501.

146) S. Rosenblum, Y.Y. Gao, P. Reinhold, C. Wang, C.J. Axline, L. Frunzio, S.M. Girvin, L. Jiang, M. Mirrahimi, M.H. Devoret, R. Schoelkopf, "A CNOT gate between multiphoton qubits encoded in two cavities," *Nature Communications* **9,** 652 (2018). DOI:10.1038/s41467-018-03059-5.

145) A. Hosseinkhani, R.-P. Riwar, R. J. Schoelkopf, L. I. Glazman, and G. Catelani, "Optimal configurations for normal-metal traps in transmon qubits," *Phys. Rev. Applied* **8**, 064028 (2018). DOI:10.1103/PhysRevApplied.8.064028.

144) S. Touzard, A. Grimm, Z. Leghtas, S.O. Mundhada, P. Reinhold, C. Axline, M. Reagor, K. Chou, J. Blumoff, K.M. Sliwa, S. Shankar, L. Frunzio, R.J. Schoelkopf, M. Mirrahimi, M.H. Devoret, "Coherent oscillations in a quantum manifold stabilized by dissipation," *Phys. Rev. X* **8**, 021005 (2018). DOI:10.1103/PhysRevX.8.021005
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143) Y. Chu, P. Kharel, W. Renninger, L.D. Burkhart, L. Frunzio, P. Rakich, R. Schoelkopf, "Quantum acoustics with superconducting qubits," *Science* **358**, Issue 6360, pp. 199-202 (2017). DOI: 10.1126/science.aao1511.

142) A.P. Reed, K.H. Mayer, J.D. Teufel, L.D. Burkhart, W. Pfaff, M. Reagor, L. Sletten, X. Ma, R.J. Schoelkopf, E. Knill, K.W. Lehnert, "Faithful conversion of propagating quantum information to mechanical motion," *Nature Physics* **13**, 1163-1167 (2017). DOI: 10.1038/NPHYS4251. (2017)

141) R.W. Heeres, P. Reinhold, N. Ofek, L. Frunzio, L. Jiang, M. H. Devoret, R. J. Schoelkopf, "Implementing a Universal Gate Set on a Logical Qubit Encoded in an Oscillator," *Nature Communications* **8**, 94 (2017). DOI: 10.1038/s41467-017-00045-1.

140) W. Pfaff, C. J. Axline, L. D. Burkhart, U. Vool, P. C. Reinhold, L. Frunzio, L. Jiang, M. H. Devoret, and R. J. Schoelkopf, "Controlled release of multiphoton quantum states from a microwave cavity memory," *Nature Physics* **13**, 882-887 (2017). DOI:10.1038/nphys4143.

139) T. Brecht, Y. Chu, C. Axline, W. Pfaff, J. Z. Blumoff, K. Chou, L. Krayzman, L. Frunzio, and R.J. Schoelkopf, "Micromachined integrated quantum circuit containing a superconducting qubit," *Physical Review Applied* **7**, 044018 (2017). DOI: 10.1103/PhysRevApplied.7.044018. **ERRATUM**: *Phys. Rev. Applied* **8**, 039902.

138) C. Shen, K. Noh, V.V. Albert, S. Krastanov, M. H. Devoret, R. J. Schoelkopf, S. M. Girvin, L. Jiang, "Quantum Channel Construction with Circuit Quantum Electrodynamics," *Physical Review B* **95**, 134501 (2017). DOI: 10.1103/PhysRevB.95.134501.

137) C. Shen, R. W. Heeres, P. Reinhold, L. Jiang, Y-K. Liu, R. J. Schoelkopf, L. Jiang, "Optimized tomography of continuous variable systems using excitation counting," Phys. Rev. A **94** (5), 052327 (2016). DOI: 10.1103/PhysRevA.94.052327.

136) Y. Chu, C. Axline, C. Wang, T. Brecht, Y. Y. Gao, L. Frunzio, R. J. Schoelkopf, "Suspending superconducting qubits by silicon micromachining," *Appl. Phys. Lett.* **109**, 112601 (2016). DOI:10.1063/1.4962327.

135) R.-P. Riwar, A. Hosseinkhani, L.D. Burkhart, Y.Y. Gao, R. J. Schoelkopf, L.I. Glazman, G. Catelani, "Normal-metal quasiparticle traps for superconducting qubits," *Phys. Rev. B* **94**, 104516 (2016). DOI:10.1103/PhysRevB.94.104516.

134) J. Z. Blumoff, K. Chou, C. Shen, M. Reagor, C. Axline, R. T. Brierley, M. P. Silveri, C. Wang, B. Vlastakis, S. E. Nigg, L. Frunzio, M. H. Devoret, L. Jiang, S. M. Girvin, R. J. Schoelkopf, "Implementing and characterizing precise multi-qubit measurements," Phys. Rev. X **6**, 031041 (2016) DOI: 10.1103/PhysRevX.6.031041.

133) W.C. Smith, A. Kou, U. +Vool, I.M. Pop, L. Frunzio, R.J. Schoelkopf, M.H. Devoret, **"**Quantization of inductively shunted superconducting circuits," *Phys. Rev. B* **94**, 144507 (2016) DOI:10.1103/ PhysRevB.94.144507.

132) U. Vool, S. Shankar, S.O. Mundhada, N. Ofek, A. Narla, K. Sliwa, E. Zalys-Geller, Y. Lui, L. Frunzio, R.J. Schoelkopf, S.M. Girvin, M.H. Devoret, **"**Continuous quantum non-demolition measurement of the transverse component of a superconducting qubit**,"** *Phys. Rev. Lett* **117**, 133601 (2016). DOI:10.1103/PhysRevLett.117.133601.

131) C. Axline, M. Reagor, R. Heeres, P. Reinhold, C. Wang, K. Shain, W. Pfaff, Y. Chu, L. Frunzio, R.J. Schoelkopf, "An architecture for integrating planar and scaling 3D cQED devices, Appl. Phys. Letter. **109**, 042601 (2016). DOI:10.1063/1.4959241.

130) A. Narla, S. Shankar, M. Hatridge, Z. Leghtas, K. M. Sliwa, E. Zalys-Geller, S.O. Mundhada, W. Pfaff, L. Frunzio, R. J. Schoelkopf, M. H. Devoret, "Robust concurrent remote entanglement between two superconducting qubits," *Phys. Rev. X* **6**, 031036 (2016). DOI: 10.1103/ PhysRevX.6.031036.

129) N. Ofek, A. Petrenko, R. Heeres, P. Reinhold, Zaki Leghtas, B. Vlastakis, Y. Liu, L. Frunzio, S. M. Girvin, L. Jiang, M. Mirrahimi, M. H. Devoret, R. J. Schoelkopf, "Extending the Lifetime of a Quantum Bit with Error Correction in Superconducting Circuits," *Nature* **536**, 441-445 (2016). DOI:10.1038 /nature18949.

128) M. Reagor, W. Pfaff, C. Axline, R.W. Heeres, N. Ofek, K. Sliwa, E. Holland, C. Wang, J. Blumoff, K. Chou, M. Hatridge, L. Frunzio, M. H. Devoret, L. Jiang, R.J. Schoelkopf. "Quantum Memory with Millisecond Coherence in Circuit QED," *Phys. Rev. B* **94**, 014506 (2016). DOI:10.1103/PhysRevB.94.014506.

127) C. Wang, Y. Y. Gao, P. Reinhold, R. W. Heeres, N. Ofek, K. Chou, C. Axline, M. Reagor, J. Blumoff, K. M. Sliwa, L. Frunzio, S. M. Girvin, L. Jiang, M. Mirrahimi, M. H. Devoret, R. J. Schoelkopf, "A Schrödinger Cat Living in Two Boxes," *Science* Vol. **352**. Issue 6289 (2016). DOI:

10.1126/science.aaf.2941.

126) V. V. Albert, C. Shu, S. Krastanov, C. Shen, R-B. Liu, Z-B. Yang, R. J. Schoelkopf, M. Mirrahimi, M. H. Devoret, L. Jiang, "Holonomic Quantum Control with Continuous Variable Systems," *Phys. Rev. Lett*. **116,** 140502 (2016). DOI:10.1103/PhysRevLett.116.140502.

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Shot Noise in a Diffusive Mesoscopic Conductor," *Phys Rev Lett* **78**, 3370-3373 (1997). DOI: 10.1103/ PhysRevLett.78.3370.

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5) R.J. Schoelkopf, J. Zmuidzinas, T.G. Phillips, H.G. Leduc, J.A. Stern, "Measurements of Noise in Josephson-Effect Mixers," *IEEE Transactions on Microwave Theory Techniques* **43**, 977-983 (1955). DOI: 10.1109/ 22.375263.

4) R.J. Schoelkopf, T.G. Phillips, J. Zmuidzinas, *"*A 100 GHz Josephson Mixer Using Resistively-Shunted NB Tunnel-Junctions," *IEEE Transactions on Applied Superconductivity Vol **3**, No 1, March 1993 Pts 2-4*, 2250-2253 (1993). DOI: 10.1109/77.233556.

3) R.J. Schoelkopf, R.L. Kelley, "Detection of Coherent 7.6 Hz Oscillations during a Burst from Aquila x-1," *Astrophysical Journal* **375**, 696-700 (1991). DOI: 10.1086/170234.

2) A. Szymkowiak, R. Kelley, G. Madejski, H. Moseley, R. Schoelkopf, B. Edwards, M. Juda, D. Mccammon, M. Skinner, J. Zhang, "High-Resolution Microcalorimeters as Detectors for Inelastic-Scattering," *Review of Scientific Instrument* **60**, 1557-1560 (1989). DOI: 10.1063/1.1141034.

1) S.H. Moseley, R.L. Kelley, R.J. Schoelkopf, A.E. Szymkowiak, D. Mccammon, J. Zhang, *"*Advances toward High Spectral Resolution Quantum X-Ray Calorimetry," *IEEE Transactions on Nuclear Science* **35**, 59-64 (1988). DOI: 10.1109/ 23.12673.

CONFERENCE PROCEEDINGS AND OTHER PUBLICATIONS

5) C. R. Monroe, R. J. Schoelkopf and M. D. Lukin, *Quantum Connections.* Scientific American, **314,** 5. (2016) 50-57.

4) A. Andre, D. DeMille, J.M. Doyle, M.D. Lukin, S.E. Maxwell, P. Rabl, R.J. Schoelkopf, P. Zoller, "Hybrid Quantum Information Processing with Polar Molecules," In C. Roos, H. Haffner, & R. Blatt, ed. *Atomic Physics 20*, vol. 869 of *American Institute of Physics Conference Series*, pp. 128–135: (2006). DOI:10.1063 /1.2400642.

3) J.D. Teufel, T.R. Stevenson, W.T. Hsieh, M.J. Li, K.W. Rhee, C.M. Stahle, E.J. Wollack, A. Assime, P. Delsing, P. Wahlgren, D.E. Prober, R.J. Schoelkopf, "Recent Progress on Photon-Counting Superconducting Detectors for Submillimeter Astronomy," *Proc. SPIE* **4855** (2003) 182-191. DOI: 10.1117/12.459712.

2) W.R. McGrath, A. Skalare, B. Karasik, M. Gaidis, B. Bumble, H.G. LeDuc, P.J. Burke, R.J. Schoelkopf, D.E. Prober, "Superconductive Hot Electron Mixers for Thz Heterodyne Receiver Applications," *Proc. SPIE* **3357** (1998) 14-21. DOI: 10.1117/12.317341.

1) B.S. Karasik, A. Skalare, W.R. McGrath, B. Bumble, H.G. LeDuc, J.B. Barner, A.W. Kleinsasser, P.J. Burke, R.J. Schoelkopf, D.E. Prober, "Low-Noise and Wideband Hot-Electron Superconductive Mixer for Thz Frequencies," *Proc. SPIE* **3465** (1998) 170-179. DOI: 10.1117/12.331162.

INVITED TALKS

98) *Quantum Computing with Superconducting Qubits*, Many-Body Quantum Systems: From Quantum Computing and Simulation to Metrology and Coherent Light-Matter Hybrids, Gordon Research Conference, Stonehill College, MA, July 2022.

97) *Superconducting Qubits as a Platform for QC*
Invited rapporteur, the 28th Solvay Conference on Physics, Brussels, Belgium, May 2022.

96) *Teaching Circuits to Act Like Atoms and Photons: a Brief History of Circuit QED* - C2QA Quantum Thursdays Lecture Series (online), February 2021.

95) *Controlling Bosonic Modes in Circuit QED* - SFB Beyond C Winter Workshop 2021 (online), February 2021

94) *What are the prospects for practical quantum computing?*
Invited speaker at The Harnack Lecture, the Max Planck Society, Berlin, Germany, October 2019

93) *Hardware-efficient quantum error correction*
Invited speaker at the 20th Anniversary of Superconducting Qubits, Tsukuba, Japan, May 2019

92) Invited speaker at the Frontiers of Nanomechanical Systems (FNS/2019), Palm Springs, CA, February 2019.

91) *The Prospects for Scalable Quantum Computing with Superconducting Circuits*
Plenary invited talk at IEEE 2018 Applied Superconductivity Conference in Seattle, Washington, November 2018.

90) *Oscillators for Quantum Information: Bosonic Quantum Error Correction*
Quantum Fluids of Light and Matter Conference, Ecole de Physique, Les Houches, France, June 2018.

89) *Introduction to Circuit QED: Quantum Optics with Microwaves*
Quantum Fluids of Light and Matter Conference, Ecole de Physique, Les Houches, France, June 2018

88) *The Prospects for Scalable Quantum Computing with Superconducting Circuits,*
Physics Colloquium, CNAM - W.J. Carr Lecture, Department of Physics, University of Maryland, February 2018.

87) *Schrodinger's Catapult: Quantum Communication with Microwave Photons,*
Special Seminar, Department of Physics, University of Maryland, February 2018.

86) *The prospects for robust, quantum computing with superconducting circuits*,
Plenary invited talk at IEEE ICRC 2017, Washington DC, November 2017.

85) *The prospects for robust, modular quantum computing with superconducting circuits*,
NASA Workshop on Quantum Computing for Aeroscience and Engineering,
Suffolk, VA, November 2017.

84) *Toward Robust, Modular Quantum Computing with Hardware-Efficient Error Correction*,
4th International Conference on Quantum Error Correction,
University of Maryland, MD, September 2017.

83) *Cavity encoding of logical qubits and robust modular computing*,
The PRACQSYS 2017, 11th Workshop, Seattle, Washington, July 2017.

82) *Toward Robust, Modular Quantum Computing with Hardware Efficient QEC*,
2017 Quantum Cavities Workshop, Orford, Quebec, Canada, June 2017.

81) *Photonic Encoding of Logical Qubits and Robust Modular Computing*,
Quantum Fluids of Light and Matter (QFLM), Corsica, France, May 2017

80) *Toward robust, modular quantum computing with hardware-efficient QEC*
Invited talk at APS March Meeting 2017, New Orleans, LA, March 2017.

79) *The prospects for quantum computing with superconducting circuits*
Frontiers in Quantum Coherent Science, Berkeley, CA, January 2017.

78) *Solid-State Quantum Computers with Error Correction,*
Physics of the Universe Summit (POTUS 2017), Andaz West
Hollywood/SpaceX /Caltech & Kavli Foundation, Los Angeles, January 2017.

77) *Oscillators for quantum information: the cat code, error correction, and two mode entanglement*
Gordon Conference on Quantum Science, Massachusetts, August 2016.

76) *Oscillators for quantum information: the cat code*, *error correction, and two mode entanglement*
International Conference on Atomic Physics (ICAP), Seoul, South Korea, July 2016.

75) *Interconnects for Superconducting Quantum Computers*
IEEE International Interconnect Technology Conference, San Jose, CA, May 2016.

74) *Extending the lifetime of quantum information through error correction.*
Southwest Quantum Information and Technology (SQUINT), Albuquerque, New Mexico, February, 2016.

73) *A Quantum Error Corrected Memory in Circuit QED*
Workshop on the Physics of Quantum Electronics, Snowbird Utah, January 2016.

72) *Extending the lifetime of a qubit through quantum error correction*.
IBM ThinkQ workshop, T.J. Watson Research Center, December 2015.

71) *Putting the Bell on Schrodinger's Cat*.
Invited talk at the workshop for 30th Anniversary of Quantronics Group, Paris, France, July 2015.

70) *Using Cat States in a Microwave Cavity for Quantum Information*
CIFAR Quantum Cavities Workshop, Aachen, Germany, June 2015.

69) *The Birth, Care, and Feeding of Cat States in Circuit QED: Quantum Jumps of Photon Parity*.
Invited talk at CLEO Conference, San Jose, CA, May 2015.

68) *Tracking a Quantum Error Syndrome in Real Time: Quantum Jumps of Photon Parity*.
Invited talk at the APS March Meeting, San Antonio, TX, March 2015.

67) *Circuit QED and Quantum Computing with Superconducting Devices*.
Max Planck Prize Winner's Ceremony, Berlin, Germany, November 2014.

66) *Circuit QED: Quantum Optics and Quantum Information with Superconducting Circuits*.
London Prize Winner's speech at International Low-Temperature Physics Conference LT-28, Buenos Aires, Argentina, August 2014.

65) *Quantum Optics with Real and Artificial Atoms*.
Discussion leader at Gordon Research Conference on Atomic Physics, Stone Hill College, Easton, Massachusetts, July 2014.

64) *Using Cat States in a Microwave Cavity for Quantum Information*.
Microsoft Workshop, Redmond WA, July 2014.

63) *Building a Quantum Computer*
Invited talk at the Microsoft Faculty Research Summit, Redmond, WA, July 2014.

62) *Using Cat States in a Microwave Cavity for Quantum Information*, Aspen Winter Workshop on Advances in Quantum Algorithms and Computation, Aspen, CO March 2014.

61) *The Future of Superconducting Quantum Computation*.
Army Research Office Workshop, Virginia, September 2013.

60) *Circuit QED, Schrodinger Cats, and Quantum Jumps of Parity*. Workshop on Cavity and Circuit Quantum Electrodynamics, Max Planck Institute, Munich, Germany, September 2013.

59) *Quantum Optics with Superconducting Circuits: From Single Photons to Schrodinger Cats*.
Canadian Institute for Advanced Research (CIFAR) Workshop on Quantum Cavities, Montreal, Canada, May 2013.

58) *Qubits, Cavities, and Quantum Error Correction*.
APS March Meeting, Baltimore MD, March 2013.

57) *Quantum Algorithms and Error Correction with Superconducting Circuits*.
SFB meeting, Innsbruck, Austria, March 2013.

56) *Quantum Optics with Superconducting Circuits: From Single Photons to Schrodinger Cats*.
New England Section of American Physical Society meeting Williams College, MA, November 2012

55) *Quantum Optics with Superconducting Circuits: From Single Photons to Schrodinger Cats*.
Conference on Quantum Noise and Measurement in Engineered Electronic Systems at the MPIPKS, October 2012.

54) *Error Correction, Improving Coherence, and the Future of Superconducting Quantum Computing*.
IARPA MQCO program review and conference, Minneapolis, MN, May 2012.

53) *Making Quantum Circuits More Coherent: Circuit QED Goes 3D!*
Collège de France, Paris, France, May 2012.

52) *Entanglement and Quantum Algorithms with Superconducting Circuits*.
Norman Hascoe Distinguished Lecture, Storrs, CT April 2012.

51) *Quantum Computing and Quantum Error Correction in Superconducting Circuits*.
Southwest Quantum Information and Technology Workshop, Albuquerque, NM, March 2012.

50) *Towards Quantum Computation with Superconducting Circuits*.
APS March Meeting invited talk, Dallas, TX, March 2011.

49) *Entanglement and Quantum Algorithms with Superconducting Circuits*.
Frontiers in Optics & Laser Science (FIO-LS) Conference, Rochester, NY, October 2010.

48) *Making and Measuring Bell States with Superconducting Circuits*.
Gordon Conference on Atomic, Molecular, and Optical Physics, Tilton, NH, July 2009.

47) *Demonstration of Quantum Algorithms with a Solid State Device*.
Nobel Committee Symposium on Qubits for Quantum Information, Gothenburg, Sweden, May 2009.

46) *Quantum Computing with Superconducting Circuits: Current Status*.
Office of Science and Technology Policy Workshop on Quantum Information Science, Vienna, VA, April 2009.

45) *Microwave Measurements of Mesoscopic Devices*.
APS Joseph F. Keithley Award Lecture, APS March Meeting, Pittsburgh PA, March 2009.

44) *Better Qubits by Design*.
Materials Research Society Fall Meeting, Boston, MA, December 2008.

43) *How Better Amplifiers Could Improve the Fidelity of Dispersive Qubit Readouts*.
First Workshop on Analog Quantum Information Processing (AQIP), Boulder, CO, October 2008.

42) *Quantum Computing with Solid-State Systems (Discussion Group Leader)*.
Gordon Conference on Quantum Information Science, Big Sky, Montana, August 2008.

41) *Circuit QED: Quantum Optics and Quantum Computing on a Superconducting Chip*.
Plenary lecture at 25th International Conference on Low Temperature Physics (LT-25), Amsterdam, the Netherlands, August 2008.

40) *Recent Results in Circuit Quantum Electrodynamics*.
Invited "Hot Topics" presentation at the 2008 International Congress on Atomic Physics, Storrs, CT, July 2008.

39) *How I Learned to Stop Worrying About 1/f Noise and Love the Charge Qubit*.
Workshop on Decoherence in Superconducting Qubits, Berkeley CA, December 2007.

38) *Quantum Optics and Quantum Computing with Superconducting Circuits*.
Workshop on Nanoelectronics, Canadian Institute for Advancement of Research, Vancouver, Canada, November 2007.

37) *Circuit QED: Quantum Optics on a Superconducting Chip*.
Invited talk at Rochester Conference on Quantum Optics (CQO9), June 2007.

36) *Quantum Optics and Quantum Computing with Superconducting Circuits*.
Symposium on 50th Anniversary of the BCS Theory of Superconductivity, Brown University, April 2007.

35) *Circuit QED: Quantum Optics on a Superconducting Chip*.
Invited seminar at College de France Paris, December 2006.

34) *QND Measurements of Qubits and Photons*.
WE-Heraeus-Seminar on "Strong Coupling of Light and Matter", Bad Honnef, Germany, September 2006.

33) *Circuit QED and the Prospects for Quantum Circuits with Polar Molecules*.
20th International Conference on Atomic Physics, Innsbruck, Austria, July 2006.

32) *QND Measurements of Qubits and Photons*.
Macroscopic Quantum Coherence and Computing MQC2 2006, Naples, Italy, June 2006.

31) *Circuit QED and the Prospects for Quantum Circuits with Polar Molecules*.
Gordon Conference on Quantum Information Processing, Il Ciocco, Italy, May 2006.

30) *Cavity QED with Polar Molecules?*
DoD Workshop on Quantum Computing with Polar Molecules, Washington, DC, September 2005.

29) *Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip*.
Gordon Conference on Atomic, Molecular, and Optical Physics, Tilton, NH June 2005

28) *Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip*.

APS Division of Atomic, Molecular, and Optical Physics Annual Meeting, Lincoln, NE, June 2005

27) *Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip*.
Gordon Conference on Quantum Information Science, Ventura, CA, March 2005

26) *Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip*.
Southwest Quantum Information Network Annual Meeting, Tucson, AZ, February 2005

25) *Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip*.
Frontiers in Nanoscale Science and Technology Workshop, Harvard University, October 2004.

24) *Experiments in Cavity QED with Superconducting Circuits*.
International Workshop on Mesoscopic Physics, Quantum Optics, and Quantum Information, ITAMP/Harvard University, May 2004.

23) *Continuous Measurements of Superconducting Qubits*.
International Conference on Solid-State Quantum Information Processing (plenary talk), Amsterdam, the Netherlands, December 2003.

22) *Superconducting Charge Qubits and the Prospects for Strong Cavity QED*.
Summer School: Quantum Entanglement and Information, Les Houches, France, July 2003.

21) *Qubits as Spectrometers of Quantum Noise*.
SPIE Conference on Fluctuations and Noise, Santa Fe, NM, June 2003.

20) *Superconducting Charge Qubits and the Prospects for Strong Cavity QED*.
AFOSR Program Review on Superconducting Quantum Computing, NY, May 2003.

19) *Superconducting Charge Qubits and the Prospects for Strong Cavity QED*.
Gordon Research Conference on Quantum Information, Ventura, CA, March 2003.

18) *Measuring Single Charges*.
Workshop on Quantum Information in Group IV Semiconductors, Oxnard, CA, March 2003.

17) *Superconducting Single-Photon Detectors for Submillimeter Astronomy*.
SPIE Conference on Astronomical Telescopes and Detectors, Kona, HI, August 2002.

16) *Quantum Coherence in Single-Charge Electronics: Engineering and Measuring a Single Spin*.
Gordon Research Conference on Correlated Electron Systems, Waterville, ME, June - August 2002.

15) *The Cooper-pair Box as a Quantum Spectrum Analyzer*.
NATO/ASI Workshop on Quantum Noise in Mesoscopic Systems, Delft, the Netherlands, June 2002.

14) *Presentation and discussion leader*.
AFOSR Workshop on Superconducting Quantum Computing, Virginia Beach, VA, March 2002.

13) *Measuring Quantum Coherence in the Single Cooper-Pair Box*.
International Symposium on Mesoscopic Superconductivity and Spintronics, NTT Laboratories,

Hon-Atsugi, Japan, March 2002.

12) *Quantum Control and Measurement of Artificial Atoms or Engineering Quantum Circuits for Fun, Physics and Technology*.
Meeting of 2001 Packard Fellows, Monterey, CA, September 2001.

11) *Fast Electrometry of Coherent Macroscopic States in the Cooper-pair Box*.
ITP Workshop on Nanoscience, Santa Barbara, CA, August 2001.

10) *Single Electron Transistor Readouts for UV thru Sub-mm Single-Photon Counting Detectors*.
9th International Workshop on Low Temperature Detectors, Madison, WI, July 2001.

9) *Probing the Dynamics of Single-Charge Circuits with Fast Electrometry*.
XXXVIth Rencontres de Moriond, Savoie, France, January 2001.

8) *Probing the Dynamics of Single-Charge Circuits with Fast Electrometry*.
International Workshop on Mesoscopic Electronics, Ascona, Switzerland, October 2000.

7) *Probing the Dynamics of Single-Charge Circuits with Fast Electrometry*.
Applied Superconductivity Conference 2000, Virginia Beach, September 2000.

6) *Far-Infrared Photon-Counting Detectors*.
NASA Workshop on Space Astrophysics Detector Development, STScI, Baltimore, MD, June 2000.

5) *A Fast Coulomb-Blockade Electrometer: Toward Single-Charge Dynamics*.
LT-22 Conference, Helsinki, Finland, August 1999

4) *A Fast Coulomb-Blockade Electrometer: Toward Single-Charge Dynamics*.
NEDO Workshop on Andreev Physics and Single Charge Tunneling, Gothenburg, Sweden, April 1998.

3) *Frequency-Dependent Noise in Mesoscopic Conductors*.
American Physical Society March Meeting, Los Angeles, March 1998.

2) *A Fast Coulomb-Blockade Electrometer: Toward Single-Charge Dynamics*.
XXXIVth Recontres de Moriond, Quantum Physics at the Mesoscopic Scale, Les Arcs, France, January 1998.

1) *Diffusion-Cooled Hot-Electron Bolometers*.
Proceedings of the International Superconducting Electronics Conference 97, Berlin, Germany, June 1997.

SEMINARS

65) *Hardware-efficient Quantum Error Correction*, The Henri Sack Memorial Lecture, Cornell Engineering, Cornell University, February 2023

64) *Error-Correction in Practice: The Cat Code and How Fault Tolerance Matters*, Monday Lunch Seminar, Yale University, August 2020

63) *Controlling Bosonic Modes in Circuit QED*, seminar at Max-Planck Institute for Light, Erlangen, Germany, October 2019

62) *The Prospects for Quantum Computing with Superconducting Circuits*, Quantum seminar at Harvard, Boston, November 2018

61) ***E**xtending the Lifetime of Information through Quantum Error Correction.*
Distinguished EE Colloquium, Stanford University, Palo Alto, CA, May 2016.

60) *Extending the Lifetime of a Qubit Through Error Correction.*
Physics Colloquium, Northwestern University, Chicago, February 2016.

59) *Extending the Lifetime of Quantum Information Through Error Correction.*
The Laboratory for Physical Sciences (LPS), University of Maryland, February 2016.

58) *Using Cat States in a Microwave Cavity for Quantum Information.*
Colloquium at NASA Goddard Space Flight Center, Greenbelt, MD, June 2015.

57) *Tracking a Quantum Error Syndrome in Real Time: Quantum Jumps of Photon Parity*.
Atomic Physics seminar at Stanford University, Palo Alto, CA, May 2015.

56) *The Birth, Care, and Feeding of Cat States in Circuit QED: Quantum Jumps of Photon Parity*.
Colloquium at RWTH Aachen University, Aachen, Germany, November 2014.

55) *The Birth, Care, and Feeding of Cat States in Circuit QED: Quantum Jumps of Photon Parity*.
Colloquium at JILA/Colorado University, Boulder, CO, September 2014.

54) *The Birth, Care, and Feeding of Cat States in Circuit QED: Quantum Jumps of Photon Parity*.
Yale Physics Colloquium for Graduate Student Open House, New Haven, CT, April 2014.

53) *The Birth, Care, and Feeding of Cat States in Circuit QED: Quantum Jumps of Photon Parity*.
Physics colloquium at Caltech, Pasadena, CA, January 2014.

52) *The Birth, Care, and Feeding of Cat States in Circuit QED: Quantum Jumps of Photon Parity*.
Physics Colloquium, California Institute of Technology, January 2014.

51) *The Birth, Care, and Feeding of Cat States in Circuit QED: Quantum Jumps of Photon Parity*.
MIT/Harvard Center for Ultracold Atoms Seminar, Massachusetts Institute of Technology, November 2013.

50) *Quantum Optics in Circuit QED: From Single Photons to Schrodinger Cats*.
Seminar, TU Vienna and University of Vienna, Vienna Austria, March 2013.

49) *Quantum Optics in Circuit QED: From Single Photons to Schrodinger Cats*.
Seminar, Max-Planck Institute for Quantum Optics, Munich Germany, March 2013.

48) *Quantum Optics in Circuit QED: From Single Photons to Schrodinger Cats*.

Seminar, University of Innsbruck, Austria, February 2013.

47) *Optics in Circuit QED: From Single Photons to Schrodinger Cats*.
Physics Colloquium, University of Chicago, Chicago IL, January 2013.

46) *Optics in Circuit QED: From Single Photons to Schrodinger Cats*.
Colloquium, Fermilab National Laboratory, Batavia IL, January 2013.

45) *Optics in Circuit QED: From Single Photons to Schrodinger Cats*.
Physics Colloquium, Northwestern University, Evanston IL, January 2013.

44) *Making Quantum Circuits More Coherent: Circuit QED Goes 3D!*
Seminar at CEA Saclay, May 2012.

43) *Entanglement and Quantum Algorithms with Superconducting Circuits*.
Physics Colloquium, Princeton University, New York, October 2011.

42) *Entanglement and Quantum Algorithms with Superconducting Circuits*.
Physics Colloquium, Columbia University, New York, October 2009.

41) *Entanglement and Quantum Algorithms with Superconducting Circuits*.
Physics Colloquium, Yale University, New Haven, September 2009.

40) *Demonstration of Quantum Algorithms with a Solid-State Device*.
Physics Colloquium, University of California, San Diego, April 2009.

39) *The Transmon: Better Superconducting Qubits by Design*.
Chez Pierre Condensed Matter Seminar, Massachusetts Institute of Technology, September 2008.

38) *Circuit QED: Quantum Optics on a Superconducting Chip*.
Physics Colloquium, Massachusetts Institute of Technology, September 2008.

37) *Circuit QED: Quantum Optics on a Superconducting Chip*.
Physics/Chancellors Colloquium, Macquarie University, Sydney, Australia, June 2008.

36) *Circuit QED: Quantum Optics on a Superconducting Chip*.
Physics Colloquium, University of Melbourne, Melbourne, Australia, May 2008.

35) *Circuit QED: Quantum Optics on a Superconducting Chip*.
Physics/EE Colloquium, University of New South Wales, Sydney, Australia, April 2008.

34) *Circuit QED: Quantum Optics on a Superconducting Chip*.
Seminar, Physics Department, University of Queensland, Brisbane, Australia, April 2008.

33) *Quantum Noise and Measurement*.
A four lecture mini-course, Centre for Quantum Computing Technology, University of New South Wales, Australia, April 2008.

32) *Circuit QED: Quantum Optics on a Superconducting Chip*.
Seminar at Joint Quantum Institute, Univ. of Maryland, College Park, MD, January 2008.

31) *Circuit QED Quantum Optics on a Superconducting Chip*.
Colloquium, Waterloo University, Montreal, Canada, March 2007.

30) *QED with Superconducting Resonators*.
Workshop on Physics and Applications of Superconducting Microresonators, California Institute of Technology, March 2007.

29) *Circuit QED: Quantum Optics on a Superconducting Chip*.
Colloquium, McGill University, Montreal, Canada, January 2007.

28) *Circuit QED: Quantum Optics on a Superconducting Chip*.
Colloquium, California Institute of Technology, November 2006.

27) *Circuit QED: QND Measurements of Superconducting Qubits and Single Photons*.
Ecole Normale Superiuere, Paris, France, May 2006.

26) *Circuit QED: QND Measurements of Superconducting Qubits and Single Photons*.
CEA/Saclay Condensed Matter Seminar, May 2006.

25) *Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip*.
Colloquium, University of Minnesota, February 2006.

24) *Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip*.
Colloquium, SUNY Stony Brook, January 2006.

23) *Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip*.
Colloquium, Amherst College, November 2005.

22) *Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip*.
Colloquium, Harvard University, April 2005.

21) *Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip*.
Quantum Information Seminar, MIT, December 2004.

20) *Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip*.
Colloquium, New York University, November 2004.

19) *Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip*.
Yale University, November 2004.

18) *Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip*.
Seminar, Rutgers, September 2004.

17) *Circuit Quantum Electrodynamics: Doing Quantum Optics on a Chip*.
Michigan State, November 2004.

16) *Experiments in Cavity QED with Superconducting Circuits*.
Laboratory for Physical Sciences/NSA, July 2004

15) *Experiments in Cavity QED with Superconducting Circuits*.
CEA/Saclay, Paris, France, May 2004.

14) *Experiments in Cavity QED with Superconducting Circuits*.
Ecole Normale Supérieure, Paris, France, May 2004.

13) *Experiments in Cavity QED with Superconducting Circuits*.
Seminar, Cornell, April 2004.

12) *Experiments in Cavity QED with Superconducting Circuits*.
Princeton, April 2004.

11) *Kondo Physics and the Lamb Shift in the Single-Electron Box*.
Solid-State Seminar, University of Minnesota, February 2006

10) *Kondo Physics and the Lamb Shift in the Single-Electron Box*.
Solid-State Seminar, Caltech, April 2004.

9) *Kondo Physics and the Lamb Shift in the Single-Electron Box*.Yale, May 2003.

8) *The Ideal Electron Gas Thermometer*.
Seminar, NIST Temperature Metrology Group, Gaithersburg, MD, January 2003.

7) *Measuring Quantum Coherence in the Single Cooper-Pair Box*.
Solid-State Seminar, UMass/Amherst, October 2002

6) *Measuring Quantum Coherence in the Single Cooper-Pair Box*.
Solid-State Seminar, SUNY Stony Brook, December 2001.

5) *Measuring Quantum Coherence in the Single Cooper-Pair Box*.
Physics Colloquium, Yale University, November 2001.

4) *Probing the Dynamics of Single-Charge Circuits with Fast Electrometry*.
Seminar, Quantronics Group, Saclay/CEA, October 2000.

3) *Probing the Dynamics of Single-Charge Circuits with Fast Electrometry*.
Physics Colloquium, Caltech, October 1999.

2) *Superconducting Single-Photon Detectors for Submillimeter Waves*.
Cosmology/Gravity Group Seminar, Princeton University, October 1999.

1) *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.

COMMITTEE SERVICE AT YALE

- Director & Member of the Advisory Committee, Yale Quantum Institute, 2014 – present
- Member, the Oversight Committees for Electronics Instrumentation and Design Center, Scientific Software Support Center, 2015.
- Member, the Oversight Committee for Yale Office of Cooperative Research (OCR), 2014-2016.
- Member, the Physical Science and Engineering Advisory Committee, 2015-2017.
- Acting Department Chair of Department of Applied Physics, 2012.
- Member of Science Hill Space Planning Advisory Committee, 2012-2013.
- Member, University Science Scholar Awards Committee, 2011-2012.
- Member, Oversight Committees for Electronics Instrumentation and Design Center, Scientific Software Support Center, 2010-2011.
- Associate Director of Yale Institute for Nanoscience and Quantum Engineering (YINQE), 2011.
- Member of Physics and Applied Physics Merger Committee, 2011.
- Co-Director of the Yale Center for Microelectronics. 2006 - 2008.
- Chairman of Cleanroom Executive Committee, 2006- 2008.
- Member of FOE Machine Shop Oversight Committee, 2006-2007.
- Member of Condensed Matter Theory Search Committee, Physics, fall 2005 - spring 2006.
- Yale Standing Committee on Majors, 2004-2005.
- Seminar "czar" for Applied Physics department – responsible for organizing two weekly seminar series, the Monday evening seminars for grad students, and the Solid-State and Optics seminar.2003-2005.
- Member, University Steering Committee. 2001-2002.
- Member, Graduate Admissions Committee, Department of Applied Physics representative to Faculty of Engineering Graduate Admissions Committee, 2000 - 2004.
- Freshman Advisor, Pierson College. 2001.
- Member, Junior Faculty Search Committee, Department of Applied Physics. 1999.
- Member, Graduate Admissions Committee, Department of Applied Physics representative to Department of Physics Graduate Admissions Committee, 1998 - 2014

EXTERNAL SERVICE

- Member of the National Quantum Initiative Advisory Committee (NQIAC)
- Panelist in the "Future of Quantum Computing" at LPS Day, the Laboratory for Physical Science of the National Security Agency, Greenbelt, Maryland. October 2019.
- Invited to participate in the "EU-US Quantum Information Science Meeting", Washington D.C., September 2019.
- Invited to participate in "Quantum Information Science (QIS) Kick Off Principal Investigators' Meeting", Bethesda, MD, January 2019.
- Invited to participate in "The Superconducting Qubit Research Coordination Meeting", MIT Lincoln Laboratory, Arlington, VA, December 2018.
- Invited to participate in "The White House Summit on Advancing American Leadership in Quantum Information Science, White House, Washington D.C., September 2018.
- Presenter at "The Quantum Information Science (QIS) Roundtable", Department of Energy, Washington

D.C., September 2018.

- Member, External Review Committee, University of Colorado Boulder, JILA, 2017.
- Member, the Advisory Panel for the David and Lucile Packard Foundation Fellowships in Science and Engineering since 2015.
- Panelist, "Underlying Technologies and Engineering Challenges for QC", Open Meeting of the Committee on Technical Assessment of the Feasibility and Implications of Quantum Computing, National Academy of Science, June 2017.
- Panelist at the Quantum Testbeds Stakeholder Workshop, hosted by Department of Energy, Washington, DC, February 2017.
- Forum on Quantum Information Science at the White House, Washington, DC, October 2016. One of five panelists invited to present opening remarks for the entire meeting, in a session entitled "State of QIS: Successes and Challenges in Research, Technology, and Commercialization."
- Panelist at the Quantum Testbeds Study Meeting, hosted by U.S. Department of Energy Washington D.C., August 2016.
- Member, the External Review Committee for NSF MRSEC center at Princeton University, 2012.
- Organizer of 2011 Les Houches Summer School, France with Michel Devoret, 2010-2011.
- Co-chair (with Michel Devoret) of Gordon Research Conference on Quantum Information Science, Barga, Italy, April 2007.
- Member of the Organizing Committee for conference on "Hybrid Approaches to Scalable Quantum Information Systems," at ITAMP/Harvard, May 2007.
- Referee for papers published in Nature, Physical Review Letters, 2007.
- Member of DARPA-sponsored Defense Science Study Group, 2004 - 2006.
- Member of JASON, a prestigious scientific advisory board involved at highest levels of national security, since 2005.
- Member of a National Research Council panel to review the performance of the National Institute of Standards programs in quantum electrical metrology, 2004 & 2005.
- Member of the Organizing Committee, National Academy workshop on Quantum Information and Coherence, Munich, Germany, 2005.
- Referee of several papers for Science, Nature, and Physical Review, reviewed proposals for National Science Foundation (NSF), 2005.
- Member of the Organizing Committee for the NATO Workshop on Quantum Noise in Mesoscopic Systems, 2001.
- Member of the Program Committee for the AFOSR Workshop on Superconducting Quantum Computing, 2001.
- Member of the Organizing Committee for the NASA Workshop on Space Astrophysics Detector Development, STScI, Baltimore, MD, June 2000.
- Referee, a proposal for AFOSR and five papers for various journals, 2000.

PUBLIC LECTURES

18) *"Taming the Quantum World: the Prospects for Practical Quantum Computation,*" Cisco Research seminar online, May 2020.

17) "The Second Quantum Revolution and the Race to Build a Quantum Computer," presentation to visiting delegation of Chinese business executives, Yale University, September 2017.
16) *The Second Quantum Revolution and the Race to Build a Quantum Computer*, Discovery at Yale event for the public, Menlo Park, CA, April 2017.
15) Panelist for *"Beyond Moore's Law,"* at the 2015 World Economic Forum in Davos, Switzerland. http://www.weforum.org/sessions/summary/beyond-moore-s-law
14) Presenter and panelist on quantum computing at Nature IdeaLabs session at World Economic Forum, 2015. https://www.youtube.com/watch?v=GV7YmbheW6s
13) *The Yale Quantum Institute: a Proposal*
Presentation to the Yale Corporation, December 2013.
12) *Forecast: Extremely Cold!*
Cryogenics presentation for 2nd graders at Kathleen Ryerson Elementary School, May 2012.
11) *Exploring the Quantum - a Conversation with Scientists*.
City University of New York, November 2011.
10) *Entanglement and Algorithms with Superconducting Circuits*.
Lecture for Perspectives on Science, Yale University, October 2009.
9) *Circuit QED: Atoms and Cavities in Superconducting Circuits*.
Tutorial in session on solid-state cavity QED, APS March Meeting, Baltimore, March 2006.
8) *Quantum Noise and Measurement*.
Four lecture series at Boulder Summer School on Mesoscopic Physics, Boulder, CO, July 2005.
7) *Quantum Optics and Quantum Computing with Superconducting Circuits*.
Talk for Annual Spring Meeting of JASON, Washington, DC, April 2005.
6) *Quantum Computing with Superconducting Circuits*.
Yale Society of Physics Students, April 2003.
5) *Single-Electronics: Circuits to Control and Measure Electrons One-by-One*.
Yale Science Forum, New Haven, CT, April 2001.
4) *The Coldest Place in Connecticut*.
Tours and demos for Yale's Tercentennial Open House, October 2000.
3) *Single Electron Devices*.
Yale Society of Physics Students, April 2000.
2) *The Small and the Cold: Nanoscale Electronics*.
Lecture in Frontiers of Science and Engineering, a Saturday program for high-school juniors, March 2000.
1) *Single Electronics*.
Perspectives on Science lecture for Yale freshman interested in majoring in science, October 1998.

PATENTS

Patent Granted:

1) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Superconducting Device with At Least One Enclosure
Singapore Patent No. 11201505616Y, December 5, 2017

2) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Superconducting Device with At Least One Enclosure
Japan Patent No. 6461009, January 11, 2019.

3) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Superconducting Device with At Least One Enclosure
U.S. Patent No. 10,424,711, September 24, 2019.

4) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Superconducting Device with At Least One Enclosure
Japan Patent No. 6744379, August 3, 2020.

5) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Superconducting Device with At Least One Enclosure
Korea Patent, 10-2178986, November 10, 2020.

6) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Superconducting Device with At Least One Enclosure
EP Patent No. 2946413, January 5, 2022.

7) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Superconducting Device with At Least One Enclosure
Italy Patent No. 502022000019910, March 2022, 2022.

8) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Superconducting Device with At Least One Enclosure
France Patent No. 2946413, March 25, 2022.

9) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Superconducting Device with At Least One Enclosure
U. K. Patent No. 2946413, March 31, 2022.

10) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Superconducting Device with At Least One Enclosure
Germany Patent No. 602014082042.5, March 31, 2022.

11) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Superconducting Device with At Least One Enclosure
Canada Patent No. xxxx, xxx xx, 2022.

12) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Methods for Making a Superconducting Device with At Least One Enclosure
Singapore Patent No. 11201505617U, December 22, 2017.

13) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Methods for Making a Superconducting Device with At Least One Enclosure
Japan Patent No. 6360499, June 29, 2018.

14) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Methods for Making a Superconducting Device with At Least One Enclosure
U.S. Patent No. 10,424,712, September 24, 2019.

15) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Methods for Making a Superconducting Device with At Least One Enclosure
Korea Patent No.10-2192270, December 11, 2020.

16) R. J. Schoelkopf, T. Brecht, L. Frunzio, M. H. Devoret,
Methods for Making a Superconducting Device with At Least One Enclosure
Canada Patent No. 2898608, January 11, 2022.

17) B. Abdo, K. Sliwa, L. Frunzio, R. J. Schoelkopf, M. H. Devoret,
Low-Noise Josephson Junction-Based Directional Amplifier.
Singapore Patent No. 11201602942U, November 27, 2018.

18) B. Abdo, K. Sliwa, L. Frunzio, R. J. Schoelkopf, M. H. Devoret,
Low-Noise Josephson Junction-Based Directional Amplifier
U.S. Patent No. 10,541,659, January 21, 2020.

19) B. Abdo, K. Sliwa, L. Frunzio, R. J. Schoelkopf, M. H. Devoret,
Low-Noise Josephson Junction-Based Directional Amplifier
Japan Patent No. 6678102, March 18, 2020.

20) B. Abdo, K. Sliwa, L. Frunzio, R. J. Schoelkopf, M. H. Devoret,
Low-Noise Josephson Junction-Based Directional Amplifier
EP Patent No. 3058618, September 2, 2020.

21) B. Abdo, K. Sliwa, L. Frunzio, R. J. Schoelkopf, M. H. Devoret,
Low-Noise Josephson Junction-Based Directional Amplifier
Germany Patent No. 602014069822.0, December 18, 2020.

22) B. Abdo, K. Sliwa, L. Frunzio, R. J. Schoelkopf, M. H. Devoret,
Low-Noise Josephson Junction-Based Directional Amplifier
Italy Patent No. 502020000114152, November 30, 2020.

23) B. Abdo, K. Sliwa, L. Frunzio, R. J. Schoelkopf, M. H. Devoret,
Low-Noise Josephson Junction-Based Directional Amplifier.
France Patent No. 3058618, January 28, 2021.

24) B. Abdo, K. Sliwa, L. Frunzio, R. J. Schoelkopf, M. H. Devoret,
Low-Noise Josephson Junction-Based Directional Amplifier.
UK Patent No. 3058618, January 28, 2021.

25) A. Narla, K. Sliwa, M. Hatridge, S. Shankar, L. Frunzio, R. J. Schoelkopf, M. H. Devoret,
Wireless Josephson Bifurcation Amplifier
U.S. Patent No. 9,948,254, April 17, 2018.

26) R. Heeres, B. Vlastakis, V. Albert, S. Krastanov, L. Jiang, R. J. Schoelkopf,
Technique of Oscillator Control for Quantum Information Processing and Related Systems and Methods
U.S. Patent No. 10,540,602, January 21, 2020.

27) A. Narla, K. Sliwa, M. Hatridge, S. Shankar, L. Frunzio, R. J. Schoelkopf, M. H. Devoret,
W*ireless Josephson Bifurcation Amplifier*
U.S. Patent No. 11,271,533, March 8, 2022.

28) R. Heeres, B. Vlastakis, V. Albert, S. Krastanov, L. Jiang, R. J. Schoelkopf,
Technique of Oscillator Control for Quantum Information Processing and Related Systems and Methods
Japan Patent No. 6710697, May 29, 2020.

29) R. Heeres, B. Vlastakis, V. Albert, S. Krastanov, L. Jiang, R. J. Schoelkopf,
Technique of Oscillator Control for Quantum Information Processing and Related Systems and Methods.
Singapore Patent No. 11201706982Y, September 1, 2020.

30) R. Heeres, B. Vlastakis, V. Albert, S. Krastanov, L. Jiang, R. J. Schoelkopf,
Technique of Oscillator Control for Quantum Information Processing and Related Systems and Methods.
China Patent No. ZL201680012252.3 February 5, 2021.

31) Z. Minev, K. Serniak, I. Pop, Y. Chu, T. Brecht, L. Frunzio, M. H. Devoret, R. J. Schoelkopf
Techniques for Coupling Planar Qubits to Non-planar Resonators and Related Systems and Methods
U.S. Patent No. 10,468,740, November 5, 2019.

32) Z. Minev, K. Serniak, I. Pop, Y. Chu, T. Brecht, L. Frunzio, M. H. Devoret, R. J. Schoelkopf
Techniques for Coupling Planar Qubits to Non-planar Resonators and Related Systems and Methods
Singapore Patent No. 11201706976X, March 9, 2021.

33) Z. Minev, K. Serniak, I. Pop, Y. Chu, T. Brecht, L. Frunzio, M. H. Devoret, R. J. Schoelkopf
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STUDENT AND ALUMNI AWARDS

- Matthew Reagor (Yale PhD 2015), now director of engineering at Rigetti Computing, was awarded the 2015 IEEE CSC Graduate Study Fellowship.

- Matthew Reed (Yale PhD 2013). His thesis was awarded the Richard L. Green Dissertation Award of the American Physical Society, and also the Northeast Council of Graduate Schools ProQuest Distinguished Dissertation Award in the Physical Sciences (2014).

- Jerry M. Chow (Yale PhD 2010, now Director, Quantum Hardware System Development at IBM Watson) - 2011 Forbes Magazine 30 Under 30 Technology, December 2012

- David Schuster (Yale PhD 2007 and postdoctoral associate, now associate professor at Stanford University) - 2011 William L. McMillan Award, University of Illinois. "Circuit Quantum Electrodynamics" - Northeastern Association of Graduate Schools (NAGS) Award for Best Doctoral

Dissertation in Physical Sciences, Mathematics, or Engineering 2007.

- Leonardo DiCarlo (postdoctoral associate, now Antoni van Leeuwenhoek full professor at Delft University of Technology) – 2009 Young Researcher Award ISEC Conference, Fukuoka Japan, June 2009

- Andrew Houck (postdoctoral associate, now professor of Electrical and Computer Engineering at Princeton) - 2008 New York Academy of Sciences, Blavatnik Postdoctoral Award

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

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

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