Kevin D. Osborn, Ph.D.

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Current Research Interests

I am interested various topics in quantum computing, including quantum coherence in superconducting resonators and qubits. Many studies have been conducted on tunneling atomic groups in amorphous and crystalline dielectric films, typically named two-level systems (TLS). Studies include 1) the measurement of individual TLS with a tunable harmonic oscillator known as the Josephson junction defect spectrometer and 2) the measurement of universal non-equilibirum amorphous-solid loss using simultaneously applied fields created by a new electrical bridge. Flux solitons are being investigated in superconducting circuits as reversible ballistic bits for energy-efficient reversible computing and quantum information control.

Scientific Activities

Principal Investigator, Laboratory for Physical Sciences, College Park, MD, 2007 – present
Research Advisor, *Current students*: B. Sarabi, and H. M. I. Jaim. *Current postdoctoral associates*: A. Ramanayaka and Y. Rosen. *Former Ph.D. students*: M. S. Khalil, Ph.D. defended in October 2014, co-advised by F. C. Wellstood. *Former postdoctoral advisees:* H. Paik, S. Gladchenko, and M. J. A. Stoutimore
LPS Seminar Series Co-Chair, with C. J. Lobb, Laboratory for Physical Sciences, Fall 2012- Spring 2013
Program Chair, Superconducting Electronics Approaching Landauer's Limit and Reversibility (SEALeR) Workshop, Annapolis, MD, Feb 2012
Session Chair, Superconducting Qubits: Resonators and Loss Mechanisms, APS March Meeting, Boston, MA, 2012
Vice Chair, Decoherence in Superconducting Qubit (DISQ) Workshop, Berkeley, CA, Dec. 2007

Employment

Staff Physicist, US Gov. Civ., Lab. for Physical Sciences, College Park, MD	2007 – Present
Research Associate and NRC Postdoctoral Fellow, NIST, Boulder, CO	2001 – 2006
Graduate Assistant, Physics, U. of Illinois at Urbana-Champaign	1995 – 2001
Graduate Assistant, Physics, U. of Tennessee at Knoxville	1992 – 1995

Education

Doctor of Philosophy, Physics, University of Illinois at Urbana-Champaign — August 2001
- "Superfluid Density Measurements of High-Temperature Superconducting Films", *advised by* Professor Dale J. Van Harlingen

Master of Science, Physics, University of Tennessee at Knoxville — August 1995
Thesis research performed at ALS, Lawrence Berkeley Nat'l Laboratory, Berkeley, CA and CAMD, Louisiana State U., Baton Rouge, LA

Bachelor of Science, Physics, Mary Washington University, VA — May 1992

Memberships and Awards

Joint Quantum Institute, Associate Fellow, 2013-present.
Center for Nanophysics and Advanced Materials, Affiliate, 2007-present.
National Research Council (NRC) Postdoctoral Fellowship, 2004 – 2006.
American Physical Society Member, 1996 – present.
Sigma Pi Sigma, Physics Honor Society, 1995.

Publications

30. “Evidence for hydrogen two-level systems in atomic layer deposition oxides,” M. S. Khalil, M. J. A. Stoutimore, S. Gladchenko, A. M. Holder, C. B. Musgrave, A. C. Kozen, G. Rubloff, Y. Q. Liu, R. G. Gordon, J. H. Yum, S. K. Banerjee, C. J. Lobb, K. D. Osborn, Appl. Phys. Lett. **103**, 162601 (2013).
29. “Bulk and Surface Tunneling Hydrogen Defects in Alumina,” Aaron M. Holder, Kevin D. Osborn, C. J. Lobb, Charles B. Musgrave, Phys. Rev. Lett. **111**, 065901 (2013).
28. “Examining the role of hydrogen in the electrical performance of in situ fabricated metal-insulator-metal trilayers using an atomic layer deposited Al2O3 dielectric,” Alexander C. Kozen, Marshall A. Schroeder, Kevin D. Osborn, C. J. Lobb, Gary W. Rubloff, Appl. Phys. Lett., **102**, 173501 (2013).
27. “Universal dielectric loss in amorphous solids from simultaneous bias and microwave field,” Alexander L. Burin, Moe S. Khalil, Kevin D. Osborn, Phys. Rev. Lett., **110**, 157002 (2013).
26. “A Josephson junction defect spectrometer for measuring two-level systems”, M. J. A. Stoutimore, M. S. Khalil, C. J. Lobb, K. D. Osborn, Appl. Phys. Lett., **101**, 062602 (2012).
25. “Squeezed noise due to two-level system defects in superconducting resonator circuits,” So Takei, Victor M. Galitski, Kevin D. Osborn, Phys. Rev. B **85**, 104507 (2012).
24. “An analysis method for asymmetric resonator transmission applied to superconducting devices,” M. S. Khalil, M. J. A. Stoutimore, F. C. Wellstood, K. D. Osborn, Journal of Applied Physics **111**, 054510 (2012).
23. “Jaynes-Cummings treatment of superconducting resonators with dielectric loss due to two-level systems”, M. Bhattacharya, K. D. Osborn, and Ari Mizel, Phys. Rev. B **84**, 104517 (2011).
22. "Loss Dependence on Geometry and Applied Power in Superconducting Coplanar Resonators", M. S. Khalil, F. C. Wellstood, K. D. Osborn, IEEE Transactions on Applied Superconductivity, **21**, 879 (2011).
21. “Decoupling a Cooper-pair box to enhance the lifetime to 0.2 ms,“ Z. Kim, B. Suri, V. Zaretskey, S. Novikov, K. D. Osborn, A. Mizel, F. C. Wellstood, B. S. Palmer , Phys. Rev. Lett. **106**, 120501 (2011).
20. “Anomalous Switching Curves in a dc SQUID Phase Qubit,” H. Kwon, A.J. Przybysz, B.K. Cooper, H. Paik, K.D. Osborn, B.S. Palmer, R. Budoyo, J.R. Anderson, C.J. Lobb, F.C. Wellstood, IEEE Transactions on Applied Superconductivity, **21**, 860 (2011).
19. "Superposition of Inductive and Capacitive Coupling in Superconducting LC Resonators," Gladchenko, S.; Khalil, M.; Lobb, C. J.; Wellstood, F. C.; Osborn, K. D.; IEEE Transactions on Applied Superconductivity, **21**, 875 (2011).
18. “Reducing quantum-regime dielectric loss of silicon nitride for superconducting quantum circuits,” Hanhee Paik and Kevin D. Osborn, Applied Physics Letters, **96**, 072505 (2010).
17. “Coherent interactions between phase qubits, cavities, and TLS defects,” R.W. Simmonds, M.S. Allman, F. Altomare, K. Cicak, K.D. Osborn, J.A. Park, M. Sillanpaa, A. Sirois, J.A. Strong, J.D. Whittaker, Quantum Information Processing, **8**, 117 (2009).
16. “Vacuum-Gap Capacitors for Low-Loss Superconducting Resonant Circuits,” K. Cicak, M.S. Allman, J.A. Strong, K.D. Osborn, R.W. Simmonds, IEEE Transactions on Applied Superconductivity, **19**, 948 (2009).
15. “Frequency-Tunable Josephson Junction Resonator for Quantum Computing,” K.D. Osborn, J.A. Strong, A.J. Sirois, R.W. Simmonds, IEEE Transactions on Applied Superconductivity, **17**, 166 (2007).
14. “Elimination of two level fluctuators in superconducting quantum bits by an epitaxial tunnel barrier,” Seongshik Oh, K. Cicak, J.S. Kline, M.A. Sillanpaa, K.D. Osborn, J.D. Whittaker, R.W. Simmonds, D.P. Pappas, Physical Review B, **74**, 100502, (2006).

13. "Epitaxial growth of rhenium with sputtering," S. Oh, D.A. Hite, K. Cicak, K.D. Osborn, R.W. Simmonds, R. McDermott, K.B. Cooper, M. Steffen, J.M. Martinis, D.P. Pappas, Thin Solid Films, **496**, 389 (2006).
12. "A single-photon pump," K.D. Osborn, M.W. Keller, Applied Physics Letters, **89**, 083518 (2006).
11. "Simultaneous state measurement of coupled Josephson phase qubits," R. McDermott, R.W. Simmonds, M. Steffen, K.B. Cooper, K. Cicak, K.D. Osborn, Seongshik Oh, D.P. Pappas, J.M. Martinis, Science, **307**, 1299 (2005).
10. "Decoherence in Josephson qubits from dielectric loss," J.M. Martinis, K.B. Cooper, R. McDermott, M. Steffen, M. Ansmann, K.D. Osborn, K. Cicak, Seongshik Oh, D.P. Pappas, R.W. Simmonds, C.C. Yu., Physical Review Letters, **95**, 210503 (2005).
9. "Low-leakage superconducting tunnel junctions with a single-crystal Al_2O_3 barrier," S. Oh, K. Cicak, R. McDermott, K.B. Cooper, K.D. Osborn, R.W. Simmonds, M. Steffen, J.M. Martinis, D.P. Pappas, Superconductor Science & Technology, **18**, 1396 (2005).
8. "HEMT Amplified SET Measurements of Individual InGaAs Quantum Dots," K. D. Osborn, Mark W. Keller, R. P. Mirin, AIP Conference Proceedings, Physics of Semiconductors: 27th International Conference on the Physics of Semiconductors, **772**, 819 (2005).
7. "Single-electron transistor spectroscopy of InGaAs self-assembled quantum dots," K.D. Osborn, M.W. Keller, R.P. Mirin, Physica E, **21**, 501 (2004).
6. "Superconducting qubits and the physics of Josephson Junctions," John M. Martinis, K. Osborn, Proceedings of Les Houches Summer School on Quantum Entanglement and Information Processing (2004).
5. "Critical dynamics of superconducting $Bi_2Sr_2CaCu_2O_{8+d}$ films," K.D. Osborn, D.J. Van Harlingen, Vivek Aji, Nigel Goldenfeld, S.Oh, J.N. Eckstein, Physical Review B **68**, 144516 (2003).
4. "Study of buried interfaces by soft x-ray fluorescence spectroscopy excited by synchrotron radiation," D.L.Ederer, J.A. Carlisle, J. Jimenez, J.J. Jia, K. Osborn, T.A. Callcott, R.C.C. Perera, J.H. Underwood, L.J. Terminello, A. Asfaw, F.J. Himpsel, JVST A **14**, 859 (1996).
3. "Variable Groovespaced grating monochromator for soft x-ray emission spectroscopy at CAMD/LSU," A. Asfaw, D. L. Ederer, L. Zhou, L. Lin, K. Osborn, T. A. Callcott, K. E. Miyano, E. Morikawa, Rev. Sci. Instrum. **66**, 1627 (1995).
2. "Two New Optical Designs for Soft-X-Ray Spectrometers Using Variable-Line-Space Gratings," K.D. Osborn, T.A. Callcott, Review of Scientific Instruments **66**, 3131 (1995).

Recent Seminars

- "Resonator Studies for Quantum Computing," Quantum Computing and Quantum Algorithm Program Review, San Diego, CA, August 13, 2013.
- "Two Level Systems in Superconducting Devices," Tulane University, February 13, 2013
- "Two Level Systems: Nonequilibrium Dynamics and ab initio screening," IARPA/ARO Coherent Superconducting Qubit Program Review, San Francisco, CA, Jan. 23, 2013.
- "Non-Equilibrium Dynamics in the Two Level Systems of Amorphous Dielectrics," NIST, Gaithersburg, MD, October 23, 2012.
- "Resonator Studies for Quantum Computing: Nonequilibrium Response of TLSs in Dielectrics," NSA/ARO Quantum Computing and Quantum Algorithm Program Review, Denver, CO, August 14, 2012.
- "From SQUIDs to Superconducting Electronics Approaching Landauer's Limit and Reversibility," SEALeR Workshop, Annapolis, Maryland, March 15, 2012.
- "Universal and NonUniversal Properties of Silicon Nitride Films," IARPA/ARO Coherent Superconducting Qubit Program Review, San Francisco, CA, Jan. 19, 2012.

- “Resonant Amorphous Defect States in Coherent Superconducting Devices,” Tulane University, Chemistry Department, October 3, 2011.
- “Resonator Studies for Qubit Coherence and Readout: The Josephson Junction Defect Spectrometer,” NSA/ARO Quantum Computing and Quantum Algorithm Program Review, Denver, CO, August 9, 2011.
- “Low-Temperature Defects in Quantum-Regime Superconducting Devices ,” JQI Seminar, University of Maryland Physics Department, College Park, MD, May 09, 2011.
- “Low Loss Amorphous Silicon Nitride,” Northrop Grumman, Linthicum, MD, February 8, 2011.