

Frederick William Strauch

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Employment

- 2008-present Assistant Professor
Department of Physics
Williams College
Williamstown, Massachusetts
- 2007-2008 Visiting Assistant Professor
Department of Physics
Gettysburg College
Gettysburg, Pennsylvania
- 2004-2007 National Research Council Postdoctoral Associate
National Institute of Standards and Technology
Gaithersburg, Maryland

Education

- 1998-2004 University of Maryland, Ph.D. in Physics
Thesis Title: Theory of Superconducting Phase Qubits
Advisor: Alex J. Dragt
- 1994-1998 Loyola College in Maryland, B.S. in Physics,
Minor in Mathematical Sciences.
Member of Phi Beta Kappa, Sigma Pi Sigma, Phi Alpha Theta, and
Alpha Sigma Nu; Honors Program participant.

Grants and Awards

1. Research Corporation Cottrell College Science Award \$40,292 (2009-present)
Project Title: Efficient Quantum Routing with Superconducting Qubits
2. National Science Foundation, \$233,186 (2010-present)
Project Title: Control and Measurement of Coupled Mesoscopic Quantum Systems
Co-PI: Kurt Jacobs, University of Massachusetts Boston

Teaching Experience

1. *Assistant Professor* (Williams College)
 - *Classical Mechanics* for junior/senior-level physics majors (Fall 2008, Fall 2010).
 - *Electromagnetism and the Physics of Matter* for non-physics science majors (Spring 2009, Spring 2010, Spring 2011).

- *Electromagnetic Theory* for junior/senior-level physics majors (Fall 2009).
- *Scientific Computing and Visualization* (Winter Study 2010).
- 2. *Visiting Assistant Professor* (Gettysburg College)
 - *Classical Mechanics* for junior-level physics majors (Fall 2007).
 - *Electromagnetism*: senior-level independent study (Fall 2007).
 - *The Evolving Universe* for non-science students (Fall 2007).
 - *Mathematical Methods* for sophomore-level physics majors (Spring 2008).
 - *Quantum Mechanics*: senior-level independent study (Spring 2008).
 - *Introductory Physics*: laboratory instructor (Fall 2007 and Spring 2008).
- 3. *Teaching Assistant* (University of Maryland)
 - *Introductory Physics*: laboratory instructor and recitation sections for non-physics science majors (Fall 1998-99, Spring 1999-2000, Summer I-II 1999-2000 with Profs. M. Rapport, S. Anlage and R. Ellis).
 - *Mathematical Methods* for graduate students in physics (Fall 2000 with Prof. A. Hassam).
 - *On-demand Tutoring*: served as on-demand lecturer for the Slawsky clinic. Students ranged from non-majors, majors, and students in engineering, with topics from introductory and general physics courses (Spring 2001).
 - *Tutorial Instructor*: Moderated sections of introductory physics, centered around modern pedagogy using the worksheets from *Tutorials in Introductory Physics* by Lillian McDermott and Peter S. Shaffer. (Spring 2001 with Prof. E. Redish).
- 4. *Mentorship*: Guided student research in theoretical quantum physics:
 - Anne Marie Forney (Spring 2008, Gettysburg College)
 - Teng Jian Khoo (Senior Thesis 2008-2009)
 - Chris Chudzicki (Summer 2009, Senior Thesis 2009-2010,
LeRoy Apker Award Winner from American Physical Society),
 - Steven Jackson (Winter 2009, Senior Thesis 2009-2010)
 - Hai Zhou (Summer 2009)
 - Qiao Zhang (Summer 2010, Winter 2011)
 - Praphruetpong “Ben” Athiwaratkun (Summer 2010)
 - Douglas Onyango (Summer 2010, Spring 2011)
 - Samyam Rajbhandari (Summer 2010, Senior Thesis 2010-2011)
 - Jared Hallett (Winter 2011)

Synergistic Activities

1. Published News & Views article for Nature: “Circuits that Process with Magic”, R. W. Simmonds and F. W. Strauch, Nature **460**, 187 (2009).
2. Referee for Physical Review Letters, Physical Review A, Physical Review B, Physical Review E, Physica A, Journal of Physics B, and the New Journal of Physics.
3. External faculty member on thesis committee at Drexel University (Summer 2008).
4. Member of Quantum Information Reading Group, Berkshire Center for Science and Religion (Spring 2009).
5. Reviewer and Panelist for National Science Foundation (2007-2010).
6. Member of Williams College Library Committee and Olmstead Prize Committee, (2009-2010).

Peer-Reviewed Publications (Student co-authors italicized)

1. “Ultraefficient cooling of resonators: Beating sideband cooling with quantum control”, X. Wang, S. Vinjanampathy, F. W. Strauch, and K. Jacobs, *Physical Review Letters* **107**, 177204 (2011).
2. “Parallel State Transfer and Efficient Quantum Routing on Quantum Networks”, C. Chudzicki and F. W. Strauch, *Physical Review Letters* **105**, 260501 (2010).
3. “Arbitrary Control of Entanglement between two Superconducting Resonators”, F. W. Strauch, K. Jacobs, and R. W. Simmonds, *Physical Review Letters* **105**, 050501 (2010).
4. “Multifrequency control pulses for multilevel superconducting quantum circuits”, A. M. Forney, S. R. Jackson, and F. W. Strauch, *Physical Review A* **81**, 012306 (2010).
5. “Reexamination of decoherence in quantum walks on the hypercube”, F. W. Strauch, *Physical Review A* **79**, 032319 (2009).
6. “Theoretical analysis of perfect quantum state transfer with superconducting qubits”, F. W. Strauch and C. J. Williams, *Physical Review B* **78**, 094516 (2008).
7. “Multilevel effects in the Rabi oscillations of a Josephson phase qubit”, S. K. Dutta, F. W. Strauch, R. M. Lewis, K. Mitra, H. Paik, T. A. Palomaki, E. Tiesinga, J. R. Anderson, A. J. Dragt, C. J. Lobb, and F. C. Wellstood, *Physical Review B* **78**, 104510 (2008).
8. “Quantum behavior of a dc SQUID phase qubit”, K. Mitra, F. W. Strauch, C. J. Lobb, J. R. Anderson, F. C. Wellstood, and E. Tiesinga, *Physical Review B* **77**, 214512 (2008).
9. “Tunneling phase gate for neutral atoms in a double-well lattice”, F. W. Strauch, M. Edwards, E. Tiesinga, C. Williams, and C. W. Clark, *Physical Review A* **77**, 050304 (2008).
10. “Any-order propagation of the nonlinear Schrödinger equation”, F. W. Strauch, *Physical Review E* **76**, 046701 (2007).
11. “Relativistic effects and rigorous limits for discrete- and continuous-time quantum walks”, F. W. Strauch, *Journal of Mathematical Physics* **48**, 082102 (2007).
12. “Strong-Field Effects in the Rabi Oscillations of the Superconducting Phase Qubit”, F. W. Strauch, S. K. Dutta, Hanhee Paik, T. A. Palomaki, K. Mitra, B. K. Cooper, R. M. Lewis, J. R. Anderson, A. J. Dragt, C. J. Lobb, and F. C. Wellstood, *IEEE Transactions on Applied Superconductivity* **17**, 105 (2007).
13. “Connecting the discrete- and continuous-time quantum walks”, F. W. Strauch, *Physical Review A* **74**, 030301 (R) (2006).
14. “Relativistic quantum walks”, F. W. Strauch, *Physical Review A* **73**, 054302 (2006).
15. “Initializing the flux state of multiwell inductively isolated Josephson junction qubits”, T. A. Palomaki, S. K. Dutta, Hanhee Paik, H. Xu, J. Matthews, R. M. Lewis, R. C. Ramos, K. Mitra, P. R. Johnson, F. W. Strauch, A. J. Dragt, C. J. Lobb, J. R. Anderson, and F. C. Wellstood, *Physical Review B* **73**, 014520 (2006).
16. “Macroscopic Tunnel Splittings in Superconducting Phase Qubits”, P. R. Johnson, W. T. Parsons, F. W. Strauch, J. R. Anderson, A. J. Dragt, C. J. Lobb, and F. C. Wellstood, *Physical Review Letters* **94**, 187004 (2005).
17. “Spectroscopy of Three-Particle Entanglement in a Macroscopic Superconducting Circuit”, H. Xu, F. W. Strauch, S. K. Dutta, P. R. Johnson, R. C. Ramos, A. J. Berkley, H. Paik, J. R. Anderson, A. J. Dragt, C. J. Lobb, and F. C. Wellstood, *Physical Review Letters* **94**, 027003 (2005).
18. “Cooper-pair box as a variable capacitor”, H. Paik, F. W. Strauch, R. C. Ramos, A. J. Berkley, H. Xu, S. K. Dutta, P. R. Johnson, A. J. Dragt, J. R. Anderson, C. J. Lobb, and F. C. Wellstood, *IEEE Transactions on Applied Superconductivity* **15**, 884 (2005).
19. “Spectroscopic resonance broadening in a Josephson junction qubit due to current noise”, H. Xu, A. J. Berkley, R. C. Ramos, M. A. Gubrud, P. R. Johnson, F. W. Strauch, A. J.

- Dragt, J. R. Anderson, C. J. Lobb, and F. C. Wellstood, *Physical Review B* **71**, 064512 (2005).
20. “Quantum control of superconducting phase qubits”, P. R. Johnson, F. W. Strauch, A. J. Dragt, J. R. Anderson, C. J. Lobb, and F. C. Wellstood, *Proceedings of SPIE Volume 5436, Quantum Information and Computation II* (2004).
 21. “Quantum Logic Gates for Coupled Superconducting Phase Qubits”, F. W. Strauch, P. R. Johnson, A. J. Dragt, C. J. Lobb, J. R. Anderson, and F. C. Wellstood, *Physical Review Letters* **91**, 167005 (2003).
 22. “Defining entanglement”, A. J. Berkley, H. Xu, R. C. Ramos, M. A. Gubrud, F. W. Strauch, P. R. Johnson, J. R. Anderson, A. J. Dragt, C. J. Lobb, and F. C. Wellstood, *Letter to Science* **301**, 1183 (2003).
 23. “Entangled Macroscopic Quantum States in Two Superconducting Qubits”, A. J. Berkley, H. Xu, R. C. Ramos, M. A. Gubrud, F. W. Strauch, P. R. Johnson, J. R. Anderson, A. J. Dragt, C. J. Lobb, and F. C. Wellstood, *Science* **300**, 1548 (2003).
 24. “Josephson-junction qubits: entanglement and coherence”, J. R. Anderson, A. J. Berkley, A. J. Dragt, M. A. Gubrud, P. R. Johnson, C. J. Lobb, R. C. Ramos, F. W. Strauch, F. C. Wellstood, and H. Z. Xu, *Superlattices and Microstructures*, Elsevier Science (2003).
 25. “Capacitively Coupled Josephson Junctions: A Two-Qubit System”, R. C. Ramos, F. W. Strauch, P. R. Johnson, A. J. Berkley, H. Xu, M. A. Gubrud, J. R. Anderson, C. J. Lobb, A. J. Dragt, and F. C. Wellstood, *IEEE Transactions on Applied Superconductivity* **13**, 994 (2003).
 26. “Spectroscopy of capacitively coupled Josephson-junction qubits”, P. R. Johnson, F. W. Strauch, A. J. Dragt, R. C. Ramos, C. J. Lobb, J. R. Anderson, F. C. Wellstood, *Physical Review B* **67**, 020509 (2003).

Scientific Talks

1. “Quantum Logic Gates for Coupled Superconducting Resonators”, American Physical Society March Meeting (Dallas Convention Center, March 21, 2011).
2. “Quantum Routing and Beyond with Superconducting Resonators”, Science Center Lunch Talk, Williams College (March 15, 2011).
3. “From cuckoos to qubits: Quantum Computing by Exciting Oscillators”, Summer Science Program Talk, Williams College (July 20, 2010).
4. “Imperfect Quantum Walks in Large Dimensions”, Black Forest Focus on Soft Matter 3, Freiburg Institute for Advanced Studies (Invited Talk, Breisach, Germany, June 5, 2010).
5. “Arbitrary Control of Entanglement between Two Superconducting Resonators”, Solid State & Optics Seminar, Yale University (Invited Talk, May 27, 2010); LANL QUEST Workshop, Santa Fe, NM (August 23, 2010); Bits and Waves Laboratory Seminar, BBN, Cambridge, MA (September 30, 2010).
6. “Arbitrary Control of Entanglement between Two Superconducting Resonators”, American Physical Society March Meeting (Oregon Convention Center, March 18, 2010).
7. “Quantum State Transfer with Superconducting Circuits”, University of Massachusetts Boston (Invited Talk, February 3, 2010).
8. “Quantum Logic Gates and Perfect State Transfer with Superconducting Phase Qubits”, Special Solid State & Optics Seminar, Yale University, (April 3, 2009).
9. “Quantum walks in the wild: perfect quantum state transfer with superconducting qubits”, Quantum Information Science Seminar, Massachusetts Institute of Technology (Invited Talk, March 30, 2009).

10. “Decoherence in the hypercube quantum walk”, American Physical Society March Meeting (Pittsburg Convention Center, March 19, 2009).
11. “From Cuckoos to Qubits: Harmonic Oscillators and Quantum Computing”, Science Center Lunch Talk, Williams College (October 7, 2008).
12. “Propagating the Nonlinear Schrödinger Equation”, American Physical Society March Meeting (New Orleans Convention Center, March 13, 2008).
13. “Perfect Quantum State Transfer with Superconducting Phase Qubits”, (Invited Talks: Amherst College, September 25, 2008; Williams College, January 8, 2008; Creighton University, December 2, 2007; Drexel University, November 1, 2007).
14. “Controlling the Quantum: From Atoms to Superconductors and Relativity to Hypercubes”, Physics Colloquium, Gettysburg College (April 14, 2007).
15. “Novel quantum transport in superconducting phase-qubit arrays”, American Physical Society March Meeting (Colorado Convention Center, March 6, 2007).
16. “Quantum Computing with Superconducting Circuits: From 2^N and Back” (Invited Talk: Reed College, January 31, 2007; Siena College, January 22, 2007; U. S. Naval Academy, January 16, 2007; Santa Clara University, January 11, 2007; University of Georgia, October 19, 2006).
17. “Strong field effects in the Rabi oscillations of the superconducting phase qubit”, poster presented at the Applied Superconductivity Conference (Seattle Convention Center, August 28, 2006).
18. “Quantum phase gate for the NIST double-well”, joint with Mark Edwards (Georgia Southern University), Quantum Information and Bose-Einstein Condensation Seminar (National Institute of Standards and Technology, August 23, 2006).
19. “Relativistic Quantum Walks”, poster presented at the Gordon Research Conference on Quantum Information Science (Il Ciocco, Barga, Italy, May 7 – May 12, 2006).
20. “Relativistic Connection of Continuous and Discrete Quantum Walks”, (Invited Talk: Naval Research Laboratory, April 6, 2006; George Mason University, February 2, 2006).
21. “Relativistic Connection of Continuous and Discrete Quantum Walks”, American Physical Society March Meeting (Baltimore Convention Center, March 16, 2006).