

Matthew D. LaHaye, Ph.D.

EMPLOYMENT ADDRESS

Syracuse University
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EXPERTISE

- Nanoelectromechanical systems (NEMS) and superconducting devices.
- The frontiers of quantum mechanics including quantum measurement and qubit technology.
- Design and fabrication of solid state electronic and mechanical systems including micro- and nano-lithography.
- Cryogenic equipment and measurement techniques.
- Sensitive electronic equipment and measurement practices.

EDUCATION

The University of Maryland, College Park (UMCP) **1999-2005**

Ph.D., experimental condensed matter physics

Advisor: Professor Keith Schwab

Dissertation Title: The Radio-Frequency Single-Electron-Transistor Displacement Detector

University at Albany, State University of New York (UAlbany) **1995-1999**

B.S., majors in physics and philosophy

Graduated Magna cum Laude

Phi Beta Kappa Inductee (1997)

PROFESSIONAL EXPERIENCE

Department of Physics, Syracuse University **2009-present**
Assistant Professor

California Institute of Technology (Caltech) **2005-2009**
Postdoctoral Scholar

Spearheaded first ever experimental investigations of the interaction between a nanomechanical system and a superconducting charge qubit.

University of Maryland, College Park **2000-2005**
Graduate Research Assistant

Designed, built and implemented a novel, ultra-sensitive, radio-frequency displacement transducer for fundamental studies of quantum measurement and quantum noise.

Graduate Teaching Assistant

1999-2000

Served as a teaching assistant for undergraduate introductory physics classes.

COURSES TAUGHT

- PHY 351/651, Instrumentation in Modern Physics. **Spring 2015.**
- PHY 451, Problems in Contemporary Physics. **Fall 2014.**
- PHY 351/651, Instrumentation in Modern Physics. **Spring 2014.**
- PHY 215, General Physics I (Mechanics) – Honors and Majors. **Fall 2013.**
- PHY 451, Problems in Contemporary Physics. Syracuse University. **Fall 2012.**
- PHY 568, Introduction to Quantum Mechanics II. Syracuse University, **Fall 2012.**
- PHY 212, General Physics II: Electricity, Magnetism and Light. Syracuse University. **Spring 2012.**
- PHY 568, Introduction to Quantum Mechanics II. Syracuse University, **Fall 2011.**
- PHY 212, General Physics II: Electricity, Magnetism and Light. Syracuse University. **Spring 2011.**
- PHY 568, Introduction to Quantum Mechanics II. Syracuse University, **Fall 2010.**
- Co-taught PHY 212, General Physics II: Electricity, Magnetism, and Light. Syracuse University, **Spring 2010.**

ADDITIONAL TEACHING/MENTORING EXPERIENCE

- Served as upper-division advisor to eight Syracuse University physics majors. **Fall 2013-Spring 2014.**
- Served as lower-division academic advisor to ~28 freshman and sophomores. Syracuse University. **Fall 2011- Fall 2014.**
- Serving as academic advisor to three current SU physics Ph.D. students. **Fall 2010-Present.**
- Conducted assessment for Syracuse University Physics Department of introductory laboratory course PHY 221: General Physics Laboratory I. **Fall 2011.**
- Tutor of high school and undergraduate mathematics and physics, Albany, NY, **1997-1998.**
- Assistant Conversational English teacher, a *Bridges for Education* summer camp, Crimea, Ukraine, **Jun.-Jul. 1997.**

SERVICE AND OUTREACH

- Helped organize spring 2015 *Visiting Day* for students accepted into the S.U. Ph.D. program. **23 Mar. 2015**

- Serving on organizing committee to host a 2016 Conference for University Women in Physics (CUWIP) at Syracuse University. **Fall 2014 to Present**
- Presented a lecture to Syracuse University's Society of Physics Students (SPS). *Quantum Mechanics in Macroscopic Limits*. **18 Nov. 2014**.
- Served as a *Capstone Reader* for one Syracuse University undergraduate in the *René Crown Honors Program*. **Spring 2014**.
- Have served on the Ph.D. thesis committees of 15 Syracuse University physics graduate students since joining the Physics Department.
- Have served on five research oral exam committees for Syracuse University physics graduate students since joining the department.
- Served on the thesis advisory committee for one senior physics Ph.D. student. **Fall 2013**.
- Served on the physics department's "Graduate Student Recruitment Committee". This includes serving as chair of the spring 2014 *Visiting Day*, which is for students accepted into the Ph.D. program. **Fall 2013-Fall 2014**.
- Presented research seminars (~90 minutes each) at Syracuse University Project Advance (SUPA) high school faculty development workshops: **08 October (Syracuse) & 25 October 2013 (Manhattan)**.
- Delivered a lecture to undergraduate students on *Mechanical Quantum Systems* at Undergraduate Research Day 2013. Physics Department, Syracuse University. **09 November 2013**.
- Co-Chair of the organizing committee for Undergraduate Research Day and Open House 2013 (URD 2013), Physics Department, Syracuse University. **09 November 2013**.
- Chair of the organizing committee for Undergraduate Research Day and Open House 2012 (URD 2012), Physics Department, Syracuse University. **01 December 2012**.
- Chair of the organizing committee for Undergraduate Research Day and Open House 2011 (URD 2011), Physics Department, Syracuse University. **05 November 2011**.
- Chair of the organizing committee for Undergraduate Research Day and Open House 2010 (URD 2010), Physics Department, Syracuse University. **30 October 2010**.
- Physics Colloquium Committee co-Chair, Physics Department, Syracuse University, **Fall 2010-Spring 2012**.
- Served on committee at Colgate University to evaluate the honors theses for three undergraduate students, **3 May 2010**.
- Physics judge for NY state mid-regional Science Olympiad, LeMoyne College, **30 Jan. 2010, 5 Feb. 2011, and 21 Jan. 2012**.

TEACHING WORKSHOPS ATTENDED

- **2010** American Association of Physics Teachers (AAPT) Workshop for New Physics and Astronomy Faculty. College Park, MD. **28 June – 01 July 2010**.

PEER REVIEW

- National Science Foundation. *IEEE Applied Superconductivity*, Israel Ministry of Science and Technology, Netherlands Foundation for Fundamental Research on Matter (FOM), *Physics Reports*, *Physica Scripta*, *The Journal of Low Temperature Physics*, *Physical Review X*, *Nano Letters*, *Nature Communications*.

PEER-REVIEWED PUBLICATION LIST

- Hao, Y., Rouxinol, F., & LaHaye, M.D. Development of a Broadband Reflective T-filter for Voltage Biasing High-Q Superconducting Microwave Cavities. *Applied Physics Letters* 105, 222603 (2014).
- Suh, J., LaHaye, M.D., Echternach, P.M., Schwab, K.C. & Roukes, M.L. Parametric Amplification and Back-Action Noise Squeezing by a Qubit-Coupled Nanomechanical Resonator. *Nano Letters* 10, 3990-3994 (2010).
- LaHaye, M.D., Suh, J. Echternach, P.M., Schwab, K.C., & Roukes, M.L. Nanomechanical Measurements of a Superconducting Qubit. *Nature* **459**, 960-964 (2009).
- Naik, A., Buu, O., LaHaye, M.D., Armour, A.D., Clerk, A.A., Blencowe, M.P. & Schwab, K.C. Cooling a Nanomechanical Resonator With Quantum Back-action. *Nature* **443**, 193-196 (2006).
- LaHaye, M.D., Buu, O., Camarota, B. & Schwab, K.C. Approaching the Quantum Limit of a Nanomechanical Resonator. *Science* **304**, 74-77 (2004).

CITATIONS

- My peer-reviewed publications have received 1132 total citations (Source: Scopus. Date: 05 May 2015).

PUBLICATIONS UNDER REVIEW

- Brito, F., Rouxinol, F., LaHaye, M.D. & Caldeira, A.O. Testing Time Reversal Symmetry in Artificial Atoms. [arXiv:1406.7182v1](https://arxiv.org/abs/1406.7182v1) (27 June 2014). Under review at *New Journal of Physics*.

CONFERENCE PROCEEDINGS

- LaHaye, M.D., Rouxinol, F., Hao, Y., Shim, S-B. & Irish, E.K. Superconducting Circuitry for Quantum Electromechanical Systems. *Proceedings of the SPIE*, 9500-48. Currently available online at [arXiv:1504.02908](https://arxiv.org/abs/1504.02908) (11 April 2015).
- Plourde, B.L.T., Wang, H., Rouxinol, F. & LaHaye, M.D. Superconducting Metamaterials and Qubits. *Proceedings of the SPIE*, 9500-21. Currently available online at [arXiv:1505.01015](https://arxiv.org/abs/1505.01015) (05 May 2015).
- LaHaye, M., Suh, J., Echternach, P., Schwab, K. & Roukes, M. Coupling a Nanomechanical Resonator to a Superconducting Qubit. *2008 Conference on Quantum Electronics and Laser Science Conference on Lasers and Electro-Optics, CLEO/QELS*. Technical Digest Series. Article Number 4552465.

ACTIVE FUNDING

- NSF Materials World Network Grant: *Investigations of Quantum Fluctuation Relations Using Superconducting Qubits*. \$260,000. Two year award beginning 15 September 2013.
- NSF Faculty Early Career Development (CAREER) Award: *Probing Quantum Behavior in Qubit-Coupled Nanomechanical Systems*. \$600,000. Five year award beginning 15 May 2011.

PENDING PROPOSALS

- 2015 Defense University Research Instrumentation Program (DURIP). AFOSR/ARO/ONR. *Acquisition of Microwave Instrumentation for the Development of Superconducting Quantum Electromechanical Systems*. \$254,236. P.I. (**Submitted November 2014.**)
- 2015 National Science Foundation, Major Research Instrumentation (MRI) program. *Acquisition of a Cryogen-Free Dilution Refrigerator for Low-Temperature Experiments with Superconducting Quantum Circuits*. \$513,370. Co-P.I. (**Submitted January 2015.**)
- 2015 Multidisciplinary University Research Initiative (MURI). AFOSR/ARO/ONR. *Macroscopic States and Control of Strongly Driven Superconducting Qubit Systems*. \$2,500,000. Co-PI. Partner institutions: University of Rochester, Imperial College (UK), University of Oxford (UK), and University of Surrey (UK). (**Submitted February 2015.**)
- 2015 Samsung Global Research Outreach. *Fluxonium-Coupled Mechanics*. \$100,000. P.I. (**Under preparation. To be submitted in May 2015.**)

AWARDS

- Syracuse University Physics Department Spring 2014 Lunch on the Department Award. Given for highest student evaluations in a graduate level class.
- Syracuse University Physics Department Fall 2013 Dinner on the Department Award. Given for highest student evaluations in a small undergraduate class.
- Syracuse University Physics Department Spring 2011 Dinner on the Department Award. Given to faculty who receive the strongest student evaluations in a large enrollment lecture class.
- ILearn Funding Award from the College of Arts and Sciences, Syracuse University for Undergraduate Research Day and Open House 2010. \$2000. **Oct. 2010.**
- Syracuse University Physics Department Travel Grant. \$800. **Dec. 2009.**
- Center for the Physics of Information Postdoctoral Scholarship, Caltech, **Aug. 2005-2007.**
- National Science Foundation Travel Grant (\$1000 plus room/board) to attend “New Directions in Mesoscopics” NATO Advanced Study Institute in Erice, Italy. **Awarded April 2002.**
- Student Scholarship (\$600 plus room/board) to attend the First International School and Conference on Nanoscale/Molecular Mechanics in Maui, HI. **Awarded March 2002.**
- Rebecca Anne Oliver Award for Outstanding Undergraduate in Physics, UAlbany, **May 1998.**
- Phi Beta Kappa National Honor Society Inductee, UAlbany, **Nov. 1997.**

- Presidential Award for Academic Achievement, UAlbany, **May 1997**.
- Presidential Scholars Program Inductee, UAlbany, **May 1997**.

CONFERENCE, WORKSHOP AND SEMINAR INVITATIONS

- Invited speaker at Quantum Science Symposium – 2015. Boston, MA. **21-22 Sep. 2015**.
<http://www.expressgenes.com/PSS2015/main.html>.
- Invited lecturer at the Quantum Information School (three 90 minute lectures) and Workshop (one 30 minute seminar) of Paraty. Paraty, Brazil. **04-15 Aug. 2015**.
<http://www.paratyquantum.info/Paraty15/en/home.php>.
- SPIE Quantum Information and Computation XIII. Baltimore, MD. **24 April 2015**.
- Physics Colloquium. University of Kansas. **20 April 2015**.
- Physics Colloquium. Colgate University. **27 Jan. 2015**.
- Invited workshop talk. 4th International Workshop on Entanglement, Decoherence and Quantum Control. Buffalo, NY. **24 Oct. 2014**
- Physics Colloquium. Williams College. Williamstown, MA. **11 April 2014**. (Cancelled for personal reasons.)
- Physics Colloquium. Sao Carlos Institute of Physics. Sao Carlos, Brazil. **19 April 2013**.
- Condensed Matter Physics Seminar. University of Campinas. Campinas, Brazil. **16 April 2013**.
- Joint Condensed Matter/Electrical Engineering Seminar. Case Western Reserve. **22 October 2012**.
- Condensed Matter Physics Seminar. Queens University. **15 March 2012**.
- Physics Colloquium. Amherst College. **17 November 2011**.
- Electrical Engineering Seminar, Syracuse University. **25 October 2011**.
- Invited conference talk. 2010 Nano-opto-electro-mechanical Systems Approaching the Quantum Regime. Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, ITR. **10 Sept. 2010**.
- Invited conference talk. 2010 International Conference on Quantum Solids and Fluids. Grenoble, FRA. **6 Aug. 2010**.
- Invited talk. 60 Years of Condensed Matter Physics at Syracuse University. **24 April 2010**.
- Invited workshop talk. Canadian Institute for Advanced Research (CIFAR), Quantum Cavities Workshop. Montreal, CAN. **10 April 2010**.
- Research seminar and tutorial. Institute of Physics, University of Campinas, Campinas, Brazil. **23-24 March 2010**.
- Invited workshop talk. The 9th NY Complex Matter Workshop, Rochester Institute of Technology, Rochester, NY USA. **10 Dec. 2009**.

- Research Seminar. Institute of Atomic and Sub-Atomic Physics Seminar, Vienna University of Technology, Vienna AT. **20 Nov. 2009.**
- Physics Department Seminar, University of Basel, Basel CH. **19 Nov. 2009.**
- Invited conference talk. WEH Quantum Measurement and Metrology With Solid State Devices. PBH DE. **5 Nov. 2009.**
- Invited Lectures. Winter Lecture Series on Complex Quantum Systems. Institute of Quantum Optics and Quantum Information (IQOQI), Vienna AT. **27 Oct. & 10 Nov 2009.**
- Invited conference talk. Quantum Nonstationary Systems. Brasilia BR. **20 Oct 2009.**
- Research seminar. Dartmouth College, Quantum/Nanophysics Seminar. Hannover, NH USA. **15 Oct. 2009.**
- Physics Department Colloquium. Syracuse University. Syracuse, NY USA. **24 Mar. 2009.**
- Invited conference talk. American Physical Society March Meeting 2009. Session Y8: Pushing the Limits of Mechanical Detection. Pittsburgh, PA USA. **20 Mar. 2009.**
- Physics Colloquium. California State University Northridge. Northridge, CA USA. **11 Mar. 2009.**
- Condensed Matter Physics Seminar. Caltech. Pasadena, CA USA. **16 Jan. 2009.**
- Condensed Matter Physics Seminar. University of Rochester. Rochester, NY. **27 Oct. 2008.**
- Research seminar. Cornell University. Laboratory of Atomic and Solid State Physics (LASSP). Ithaca, NY USA. **24 Oct. 2008.**
- Invited workshop talk. Nanomechanical Systems Approaching the Quantum Regime 2008. Munich, DE. **17 Sept. 2008.**
- Invited conference talk. The Conference on Lasers and Electro-Optics/Quantum Electronics and Lasers Conference (CLEO/QELS) 2008. San Jose, CA USA. **5 May 2008.**
- Invited conference talk. Moriond 2008. Quantum Transport and Nanophysics. La Thuille, IT. **14 Mar. 2008.**
- Solid State and Optics Seminar. Yale University. New Haven, CT USA. **05 Mar. 2008.**
- Invited workshop talk. The Principles and Applications of Control in Quantum Systems (PRACQSYS) 2007. Sydney, NSW AU. **13 Jul. 2007.**
- Invited workshop talk. The Kavli Nanoscience Institute Workshop on Quantum Electromechanical Systems. Morro Bay, CA USA. **15 Dec. 2006.**
- Invited conference talk. WE-Heraeus, Challenges of Applied Cryoelectrics. Weilburg, DE. **23 May 2006.**
- Condensed Matter Physics Seminar. Caltech. Pasadena, CA USA. **28 Oct. 2005.**
- Invited Conference talk. International Conference on Nanoelectronics, Nanostructures, and Carrier Interaction, NTT Basic Research Laboratories, Atsugi, JP. **01 Feb. 2005.**

- Research seminar. Harvard University. Center for Imaging and Mesoscale Systems (CIMS) Seminar. Cambridge, MA USA. **13 Jan. 2005.**
- Research seminar. Yale University. New Haven, CT USA. **30 Nov. 2004.**
- Condensed Matter Physics Seminar. Caltech. Pasadena, CA USA. **22 Oct. 2004.**

GRADUATE STUDENTS MENTORED

- Kun Gao. **May 2010- Aug. 2011**
- Yu ‘Hugo’ Hao (**Fall 2011-Present**)
- Peng Zeng (**Informally, Summer 2012**)

POSTDOCTORAL RESEARCHERS MENTORED

- Francisco Rouxinol. **Oct. 2010- Present.**

UNDERGRADUATE AND HIGH SCHOOL STUDENT RESEARCH EXPERIENCE

- Andrew Ballard, Syracuse University. **Fall 2014-Present.**
- John Cole. University of Rochester. **May 2014-Aug. 2014**
- Ryan Izant. Fayetteville-Manlius High School (Now an undergraduate at Brown University). **Summer 2013.**
- Stephen McMillan. Syracuse University. (Now a Ph.D. student at University of Iowa.) **Fall 2011-Spring 2012.**
- Thuc Mai. Syracuse University. (Now a Ph.D. student at Ohio State.) **Fall 2010-Spring 2011**
- Eric Rosenthal. Fayetteville-Manlius High School (Now at University of Pennsylvania. Will pursue Ph.D. at University of Colorado, Boulder in Fall 2015.). **Summer 2011.**

VISITORS HOSTED AT SYRACUSE UNIVERSITY

- Prof. Andrew Jordan (University of Rochester). **16 Apr. 2015.**
- Dr. Adam Sears (Lincoln Lab – M.I.T.). **3 Apr. 2015.**
- Prof. Frederick Strauch (Williams College). **21 Nov. 2014.**
- Prof. Mishkat Bhattacharya (Rochester Institute of Technology). **01 Nov. 2013.**
- Sang-Goon Kim (Korean Research Institute of Science and Standards). **30 Dec. – 07 Mar. 2013**
- Prof. Hong Tang (Yale University). **14 Feb. 2013.**
- Prof. Rob Knobel (Queen’s University). **22 Feb. 2013.**
- Prof. Aashish Clerk (McGill University). **26 Apr. 2012.**
- Prof. Frederico Brito (IFSC Universidade de São Paulo). **04 – 14 Apr. 2012 & 31 Oct. – 14 Nov. 2012. 11 – 22 Apr. 2014. 21 Jul. – 02 Aug. 2014. 04 Mar. – 10 Mar. 2015.**

- Dr. Seung-Bo Shim (Korean Research Institute of Science and Standards). **01 Apr. 2012- 31 Mar. 2013**. Will be working in my group as a visiting scientist for one year.
- Prof. Amir Caldeira (University of Campinas, Campinas, Brazil). **16 Mar. – 23 Apr. 2012** (plus several other short terms visits).
- Prof. Victor Yakovenko (University of Maryland, College Park). **19 Jan. 2012**
- Dr. Ben Palmer (Laboratory for Physical Sciences, University of Maryland, College Park and National Security Agency). **21 Oct. 2011**.
- Dr. Michael Fitelson (Chief Scientist, Micro-Systems Enablers, Northrop Grumman Electronic Systems). **05 Aug. 2011**.
- Prof. Philip Feng (Case Western Reserve. **22 Apr. 2011**).
- Prof. Konrad Lehnert (NIST-JILA Fellow, Univ. Colorado Boulder). **10 Feb. 2011**.
- Prof. Jack Harris (Yale University). **28 Oct. 2010**.
- Prof. Sunil Bhave (Cornell University). **01 Oct. 2010**.
- Prof. Miles Blencowe (Dartmouth College). **01 April 2010**.
- Dr. Jean-Savin Heron (Joseph Fourier University, Grenoble, France). **11 Dec. 2009**.
- Prof. Kurt Jacobs (University of Massachusetts, Boston). **04 Dec. 2009**.
- Prof. Philippe Jacquod (The University of Arizona). **08 Oct. 2009**.

MISCELLANEOUS

- Assisted the physics graduate admissions committee in 2010, 2011, 2012, 2014, & 2015 to contact prospective and accepted physics Ph.D. program applicants (15+ students contacted).
- Served on panel for new faculty orientation at Syracuse University to discuss experiences as a junior faculty. **24 Aug. 2011**.
- Have substituted as a lecturer in several classes offered in the Physics Department: PHY 212 (Intro E&M), PHY 360 (Waves/Vibrations), PHY 361 (Intro to Modern Physics), PHY 661 (Graduate Quantum I), & PHY 641 (Graduate E&M II).
- Co-wrote the piece “Superconducting Qubits at the Quantum Frontier (At Syracuse)” with Prof. Britton Plourde for *Physics Matters* Vol. 5, the yearly newsletter for the Physics Department. **Fall 2010**.