CHRISTOPHER G. LEVEY

Director, Microengineering Laboratory
Thayer School of Engineering
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EDUCATION

Doctor of Philosophy in Physics, University of Wisconsin-Madison, 1984
Ph.D. Dissertation: Excitation of the $^1S_0$ State of Pr^{3+} in Insulating Crystals.
Dissertation Advisor: William M. Yen (minor: EE, advisor Bahaa E.A. Saleh)
Bachelor of Arts, Carleton College, Northfield, MN., 1977
Major: Physics. Cum Laude.

APPOINTMENTS

1/93 -present **Microengineering Laboratory Director**, Dartmouth Thayer School of Engineering (mgr-'95), **Instructional Associate Professor of Engineering** (June 2006), **Research Assistant Professor of Engineering** (April 1996), and **Adjunct Associate Professor of Physics**. Microfabrication technology, microelectromechanical systems (MEMS), stress engineering in MEMS, micro-robots, binary optics, stiction, ice physics and devices, microfluidic devices, integrated inductors.

1/97 -present **Director of Instructional Labs** Dartmouth Thayer School of Engineering. Long range planning and budgeting for labs, introduction of new laboratory experiences, demonstrations, and instructional pedagogy.

1/97 -present **Director of Safety.** Safety training, safety policies and long range plans for the Engineering School, response to environmental and safety concerns.

9/90 -3/91 **Visiting Scientist (sabbatical leave)**, Applied Research Division, **Bell Communications Research** (Superconducting FETs, electromodulation, photoinduced absorption, and bolometric response of high Tc films. Superconductor device fabrication. Resident scientist 9/90-3/91, ongoing research collaboration through 1992.

10/86 -12/92 **Assistant Professor of Physics**, Department of Physics and Astronomy, **Dartmouth College**. Optical and electrical properties of high T_c superconductor films and devices (photoinduced absorption, electroabsorption and bolometric response), optical properties of ferroelectric films, laser ablation deposition of thin film materials, single mode pulsed dye laser design.

9/84-10/86 **Postdoctoral Member of Technical Staff**, Semiconductor Electronics Research Department (D.V. Lang), Physics Division, **AT&T Bell Laboratories**, Murray Hill, NJ. Conducting polymers. Dynamics of solitons and triplet excitons in quasi one-dimensional systems. Light induced electron spin resonance and excited state absorption based optically detected magnetic resonance (ODMR) in polyacetylene and polydiacetylene.

1/78-8/84 **Research Assistant**, Solid State Laser Spectroscopy group, Physics Department, **University of Wisconsin-Madison**. Multi-photon investigation of the high lying $^1S_0$ state of Pr^{3+} and 4f-5d configurational interactions. Excited state two-photon absorption.

PUBLICATIONS:

C. G. Levey, I. Paprotny, and B. R. Donald, "MicroStressBots: Species Differentiation in Surface Micromachined Microrobots", Chapter 6 in Small-Scale Robotics From Nano-to-Millimeter-Sized Robotic Systems and Applications, Lecture Notes in Computer Science series, Springer, DOI: 10.1007/978-3-642-55134-5_6, ISBN: 978-3-642-55133-8 (2014)

Di Yao, Christopher G. Levey, Charles R. Sullivan, "Microfabricated V-Groove Power Inductors Using Multilayer Co-Zr-O Thin Films for Very-High-Frequency DC-DC Converters", IEEE Transactions on Power Electronics **28**, 4384 – 4394, DOI: 10.1109/TPEL.2012.2233760 (2013).

M. L. Lifson, C. G. Levey, U. J. Gibson, "Diameter and Location Control of ZnO Nanowires for Piezoelectric Nanogenerators", Applied Physics A, 113: 243–247, DOI: 10.1007/s00339-012-7538-6 (2013).

B. R. Donald, C. G. Levey, Daniela Rus, and I. Paprotny, "Planning and Control for Microassembly of Structures Composed of Stress-Engineered MEMS Microrobots", International Journal of Robotics Research **32**, 218-246, DOI: 10.1177/0278364912467486 (2013)

C. R. Sullivan, D. V. Harburg, J. Qiu, C. G.Levey, D. Yao, D., "Integrating Magnetics for On-Chip Power: A Perspective", IEEE Transactions on Power Electronics, **28**, 4342 – 4353, DOI: 10.1109/TPEL.2013.2240465 (2013)

M. Araghchini, J. Chen, V. Doan-Nguyen, D. V. Harburg, D. Jin, J. Kim, M. S. Kim, S. Lim, B. Lu, D. Piedra, J. Qiu, J. Ranson, M. Sun, M. X. Yu, H. Yun, M. G. Allen, J. A. Alamo, G. DesGroseilliers, F. Herrault, J. H. Lang, C. G. Levey, C. B. Murray, D. Otten, T. Palacios, D. J. Perreault, C. R. Sullivan, "A Technology Overview of the PowerChip Development Program", IEEE Transactions on Power Electronics, **28**, 4182 – 4201, DOI: 10.1109/TPEL.2013.2237791 (2013)

B. R. Donald, C. G. Levey, I. Paprotny, and D. Rus, "Simultaneous Control of Multiple MEMS Microrobots", Springer Tracts on Advanced Robotics V57, 69-84 , edited by Gregory S. Chirikjian, Howie Choset, Marco Morales, Todd Murphey (2010)

B. R. Donald, C. G. Levey, and I. Paprotny, "Planar Microassembly by Parallel Actuation of MEMS Microrobots", Journal of Microelectromechanical Systems **17**, 789-808 (2008)

B. R. Donald, C. G. Levey, C. D. McGray, I. Paprotny, and D. Rus. "An Untethered, Electrostatic, Globally-Controllable MEMS Micro-Robot", J. Microelectromechanical Systems **15**, 1-15 (2006).

B. R. Donald, C.G. Levey, C. McGray, D. Rus, and M. Sinclair "Untethered Micro-Actuators for Autonomous Micro-robot Locomotion: Design, Fabrication, Control, and Performance", Robotics Research, eds. P. Dario and R. Chatila. Springer-Verlag (London), pp.502-516 (2005).

B. R. Donald, C. G. Levey, C. D. McGray, Daniela Rus, Mike Sinclair. "Power Delivery and Locomotion of Untethered Micro-Actuators", J. Microelectromechanical Systems **12**, 947-959 (2003).

N. N. Khusnatdinov, V. F. Petrenko, and C. G. Levey, "Electrical Properties of the Ice/Solid Interface", J. Phys. Chem. B **101** (32) 6212-6214 (1997)

T. Hochwitz, A. K. Henning, C. G. Levey, C. P. Daghlian, J. Slinkman, "Capacitive Effects on Quantitative Dopant Profiling with Scanned Electrostatic Force Microscopes", J. Vac. Sci. Technol. B, **14**, 457 (1996)

T. Hochwitz, A. K. Henning, C. G. Levey, C. P. Daghlian, J. Slinkman, James Never, Phil Kaszuba, Randy Wells, John Pekarik, Bob Gluck, "Imaging Dopant Profiles of Integrated Circuit Devices with the Force-Based Scanning Kelvin Probe Microscope", J. Vac. Sci. Technol. B, **14**, 440 (1996)

C. K. Sieracki, C. G. Levey, and E. W. Hansen, "Simple Binary Optical Elements for Aberration Correction in Confocal Microscopy", Optics Letters **20**, 1213 (1995).

C. G. Levey, S. Etemad, and A. Inam, "Optically Detected Transient Thermal Response of High T_c Epitaxial Films", Appl. Phys. Lett. **66**, 126 (1992).

C. G. Levey, "Enhancement of the Second Order Judd-Ofelt Transition Rates for High-Lying $(4f)^n$ States", J. Lumin **45**, 168 (1990).

C. G. Levey, D. V. Lang, S. Etemad, G. L. Baker, and J. Orenstein, "Photo-Generation of Spins in Trans Polyacetylene", Synthetic Metals **17**, 576 (1987)

C. G. Levey, T. J. Glynn, and W. M. Yen, "Excitation of the $^1S_0$ State of Pr^{3+} in Crystal Hosts", J. Lumin. **31/32**, 245 (1984).

G. N. Xiong, C. G. Levey, and W. M. Yen, "Anomalous Temperature Dependence of the Homogeneous Linewidth of the $^5D_1$- $^7F_0$ Transition of Eu^{3+} in PbF_3", Phys. Rev. **B28** (RC), 5357 (1983).

M. M. Broer, C. G. Levey, and W. M. Yen, "Fast Chopper for Time-Resolved Resonant Fluorescence Line Narrowing", Rev. Sci. Inst. **54**, 76 (1983).

W. M. Yen, C. G. Levey, S. Huang, and S. T. Lai, "Multi-photon and Multi-ion Effects in the Spectra of $Pr_{1-x}La_xF_3$", J. Lumin. **24/25**, 659 (1981).

M. M. Broer, C. G. Levey, E. Strauss, and W. M. Yen, "Variable Birefringent Beamsplitter", Appl. Optics **20**, 1011 (l981).

J. P. Hessler, J. Hegarty, G. F. Imbusch, C. G. Levey, and W. M. Yen , "Luminescence of U^{3+} in $LaBr_3$", J. Lumin. **18/19**, 73 (1979).

CONFERENCES:

Daniel V. Harburg, Alex J. Hanson, Yue Song, Jizheng Qiu, Rui Tian, Christopher G. Levey Charles R. Sullivan David Otten "Measured Performance and Micro-Fabrication of Racetrack Power Inductors, Energy Conversion Congress and Exposition (ECCE) proceedings, pp 614-620, DOI: 10.1109/ECCE.2013.6646758 (2013)

D. V. Harburg, G. R. Khan, F. Herrault, J. K. Kim, C. G. Levey, and C. R. Sullivan, "On-Chip RF Power Inductors with Nanogranular Magnetic Cores using Prism-Assisted UV-LED Lithography", 17th International conference on Solid-State Sensors, Actuators and Microsystems proceedings, pp 701 - 704, DOI: 10.1109/Transducers.2013.6626863 (2013)

C. G. Levey, I. Paprotny, and B. R. Donald "MicroStressBot Species: a Surface MEMS perspective"; invited talk for The Different Sizes of Small-Scale Robotics: from Nano- to Millimeter-Sized Robotic Systems, ICRA Workshop, May 6, 2013. [Published in ICRA 2013 Workshops and Tutorials Proceedings]

Igor Paprotny, Christopher G. Levey, Paul K. Wright, and Bruce R. Donald, "Turning-rate Selective Control : A New Method for Independent Control of Stress-engineered MEMS Microrobots", 2012 Robotics Science and Systems (RSS), Sydney, Australia.

D. Harburg, Xuehong Yu, F. Herrault, C.G. Levey, M. Allen, and C.R. Sullivan, "Microfabricated thin-film inductors for on-chip power conversion" VDE International Conference on Integrated Power Electronics Systems (CIPS), March 2012.

D. Yao, C. G. Levey, C. R. Sullivan, "Microfabricated V-Groove Power Inductors Using Multilayer Co-Zr-O Thin Films for Very-High-Frequency DC-DC Converters", DOI: 10.1109/ECCE.2011.6064010, IEEE Energy Conversion Congress and Exposition (ECCE) 2011.

Engineer of the Future 2.0: Summit on Transforming Engineering Education, March 31-April 1, 2009, Franklin W. Olin College of Engineering, Needham, MA 2009.

B. R. Donald, C.G. Levey, and I. Paprotny, "Assembly of Planar Structures by Parallel Actuation of MEMS Microrobots", Technical Digest of the Solid State Sensor and Actuator Workshop, Hilton Head 2008. TRF catalog number 08TRF-0001, Library of Congress Control Number 2008924361, 2008.

B. R. Donald, C. Levey, C. McGray, I. Paprotny, D. Rus, "A Steerable, Untethered, 250 x 60 μm MEMS Mobile Micro-Robot. 12th International Symposium of Robotics Research (ISRR), October 12-15, 2005, San Francisco, CA, published in Springer Tracts on Advanced Robotics V28, Robotics Research, Springer-Verlag (London), 2007.

B. R. Donald, C. Levey, C. McGray, D. Rus, and M. Sinclair, "Untethered Micro-Actuators for Autonomous Micro-robot Locomotion: Design, Fabrication, Control, and Performance" 11th International Symposium of Robotics Research (ISRR), October 19-22, 2003, Siena, Italy, published in Springer Tracts on Advanced Robotics V15, Robotics Research, eds. P. Dario and R. Chatila. Springer-Verlag (London), pp.502-516, 2005.

Yu Lin, C.R. Sullivan, C.G. Levey, U.J. Gibson, "Effect of evaporative deposition angle on anisotropy in Co-MgF2 nanocomposite soft magnetic materials", Digest of INTERMAG 2003. International Magnetics Conference, Boston MA, USA (Cat. No.03CH37401) : AD-05, 2003.

S. Prabhakaran, C.R.Sullivan, C.G.Levey, and K. Venkatachalam. "Fabrication of Thin Film V-Groove Inductors using Composite Magnetic Materials." IMAPS Advanced Technology Workshop (ATW) on Passive Integration, Ogunquit, Maine, June 2002.

C. Levey, "The Unified Project Lab" and " Technology in the Future: Collaborative Tools", two informal presentations, Project Kaleidoscope Summer Institute on Learning and Teaching in the Age of Information Technology: Technology in Classrooms Large and Small and in Research-Training Environments, July 14-18, 2001, Snowbird, UT.

S. Prabhakaran, D. E. Kreider, Yu Lin, C. R. Sullivan, and C. G. Levey. "Fabrication of Thin-Film V-Groove Inductors Using Composite Magnetic Materials." IEEE International Workshop on Integrated Power Packaging, IWIPP 2000, Waltham, MA, July 2000

B. R. Donald, C.G. Levey, C.D. McGray, D. Rus, M. Sinclair,"Power delivery and locomotion of untethered micro-actuators", Proceedings IEEE Sixteenth Annual International Conference on Micro Electro Mechanical Systems, 19-23 Jan. 2003, Kyoto, Japan (Cat. No.03CH37426) : 124-9, 2003

B. R. Donald, C. Levey, C. McGray, I. Paprotny, D. Rus, M. Sinclair, "Untethered Micro-Actuators for Autonomous Micro-robot Locomotion: Design, Fabrication, Control, and Performance", 11th International Symposium of Robotics Research (ISRR), October 19-22, 2003, Siena, Italy.

C. G. Levey, "The Science and Technology of Micro-machines: Development of an Undergraduate Course and Summer Workshop. II. Micro-machine Laboratory Work and Design Projects." Invited talk, Intensive Short Workshop in Micro-Electro-Mechanical Systems (MEMS) Curriculum Development , Chicago, IL. Sponsored by NSF and the U. of Illinois at Chicago, August 1995.

A. K. Henning and C. G. Levey, "The Science and Technology of Micro-machines: Development of an Undergraduate Course.", Proc. Eleventh Biennial University/Government/Industry Microelectronics Symposium, Austin TX, (Cat. No.95CH35779), pp. 230-236, IEEE, Piscataway, NJ, 1995.

T. Hochwitz, A. K. Henning, C. G. Levey, C. P. Daghlian, J. Slinkman, J. Never, P. Kaszuba, R. Gluck, R. Wells, R. Bolam, and P. Coutu, "Surface Studies with the Force-Based Scanning

Kelvin Probe." Presented (by T. Hochwitz) at the Industrial Applications of Scanned Probe Microscopy Workshop National Institute of Standards and Technology, Gaithersburg, MD., May 2-3, 1995.

A. K. Henning, T. Hochwitz, C. G. Levey, C. P. Daghlian, J. Slinkman, J. Never, P. Kaszuba, R. Gluck, R. Wells, R. Bolam, and P. Coutu, "Applications of Scanning Probe Microscopy to Problems in Microelectronic Device Failure Analysis." Presented (by A. K. Henning) at the Scanning Microscopy International conference, Houston, TX., May 9-11, 1995.

A. K. Henning and C. G. Levey, "Undergraduate research in micro-fabrication science and technology at Dartmouth College." ASEE 1994 Annual Conf. Proc., pp. 2599-2606 (peer reviewed), American Society for Engineering Education, Washington, DC, 1994.

C. G. Levey, S. Etemad, and A. Inam, "Nanosecond transient optical spectroscopy in high T_c materials", Bull. Am. Phys. Soc., **36**, 880 (1991). March Meeting of the American Physical Society, Cincinnati, 1991.

C. G. Levey and J. Orenstein, "A Novel One Dimensional Triplet Exciton in Polydiacetylene", presented at Sixth International Conference on Dynamical Processes in Excited States of Solids, 1989.

C. G. Levey, "Enhancement of the Second Order Judd-Ofelt Transition Rates for High-lying $(4f)^n$ States", presented at Sixth International Conference on Dynamical Processes in Excited States of Solids, 1989.

C. G. Levey and J. Orenstein, "The Triplet Excited State in Several Polydiacetylenes", Bull. Am. Phys. Soc., **32**, 431, 1987, March Meeting of the American Physical Society, New York, 1987.

C. G. Levey and J. Orenstein, "The Triplet Excited State in Polydiacetylene: A Bound Soliton Pair", MRS 1986 Fall Meeting, Final Program and Abstracts, p. 704.

C. G. Levey, D. V. Lang, G. L. Baker, S. Etemad, and J. Orenstein, "Photo-Generation of Spins in Trans-Polyacetylene", MRS Fall Meeting Final Program and Abstracts, 259, 1985. Symposium on Transport and Excitation in Polymers, Materials Research Society Meeting, Boston, MA., 1985.

C. G. Levey, T. J. Glynn, and W. M. Yen, "Excitation of the $^1S_0$ State of Pr^{3+} in Crystal Hosts", ICL Technical Digest, TuD16-1, 1984, International Conference on Luminescence, Madison, WI. 1984.

C. G. Levey, and W. M. Yen, "Excitation of the $^1S_0$ State of Pr^{3+} in Crystal Hosts", Bull. Am. Phys. Soc. **29**, 503, 1984, March Meeting of the American Physical Society, Detroit, Mi. 1984.

C. G. Levey and W. M. Yen, "Three Photon Excitation of the $^1S_0$ State of Pr^{3+}", J. Opt. Soc. Am. **73**, P1392, 1983, 4th International Conference on Dynamical Processes in Excited States of Solids, Stanford University, Palo Alto, CA., l983.

C. G. Levey, invited participant, Workshop on Laser Acceleration of Particles, Los Alamos National Laboratory, Los Alamos, NM., 1982.

C. G. Levey, and W. M. Yen, "Three Photon Excitation of the $^1S_0$ State of LaF_3:Pr^{3+}" Bull. Am. Phys. Soc. **26**, 298 (1981), March Meeting of the American Physical Society, Phoenix, AZ., 1981.

C. G. Levey, Shihua Huang, and W. M. Yen, "Two-Photon Absorption of LaF_3:Pr^{3+}", J. Opt. Soc. Am. **70**, 1594 (1980), Meeting of the Optical Society of America, Chicago, IL., 1980.

R. Quimby, C. G. Levey, and W. M. Yen (presented by Levey), "Photoacoustic Theory Including Energy Transfer", Bull. Am. Phys. Soc. **25**, 419, 1980. March Meeting of the American Physical Society, New York, NY., 1980.

INVITED GENERAL TALKS

Analog Devices Seminar "Micro-assembly using Stress-engineered MEMS Micro-Robots", March 4, 2010, Christopher Levey.

Olin College Seminar, "Micro-Robots and Stress Engineered Microsystems", December 18, 2007.

Jones Seminar, Dartmouth College Thayer School of Engineering, "Micro-Robots, Micro-Turbines, and Stress Engineering in MEMS", May 19, 2006.

Analog Devices Lunch Seminar, "Micro-Robots, Micro-Turbines, and Stress Engineered Microstructures", March 2, 2006.

Yen Seminar, University of Wisconsin-Madison, Physics Department, "Micro-Robots", June 24, 2005.

Dartmouth EET Faculty Seminar, "Integrated Machines and Very Small Parts: Microfabrication beyond Electronics", March 3, 1998.

OTHER PRESENTATIONS

C. G. Levey, "Using the iPad in the Engineering Classroom", Dartmouth Center for Advancement and Learning, Teaching With Technology presentation, November 5, 2011.

INVITED BOOK REVIEWS

C. G. Levey, invited review of "Solid State Physics Simulations", by I. Johnston, G. Keeler, R. Rollins, and S. Spicklemire (Wiley, 1996), Computers in Physics, **10**(2), May/June issue (1996).

C. G. Levey, invited review of "Electronics for Physics Experiments Using the Apple Computer" by J. W. Snider and J. Priest, Am. J. Phys **58**, 412 (1990).

POPULAR PRESS INTERVIEWS

Dartmouth Engineer, "Shop Talk, Life in the Project Labs", by Kathryn Loconte, Winter 2008.

Dartmouth Engineer, "The World's Smallest Untethered Robot", by Adrienne Mongan, Fall 2007

Electronics Design Strategy News, "Microrobot crawls under remote control", by Matthew Miller, online-EDN, March 2, 2006.

PC Magazine , "Robot Dust". By: Karen Jones, 12/6/2005, Vol. 24 Issue 22, p26-45

National Geographic News, October 26, 2005 "New Microscopic Robot's Tiny Step Is a Huge Leap". by Brian Handwerk.
http://news.nationalgeographic.com/news/2005/10/1026_051026_tiny_robot.html

WCAX Channel 3 Nightly News (Vermont), October 6, 2005, Ph.D. "Micro Robots". Reported By Nicole Oliverio.

Valley News, September 26, 2005, "Think Smaller: Dartmouth-Led Team Builds Tiniest Robot" . By Jessica T. Lee.

New Scientist, September 16, 2005 , "Tiniest remote-controlled robot created" . By Celeste Biever.

C. G. Levey, "Beyond Cookbook Labs", Directions, Thayer School of Engineering, Vol. **14**, No. 1, pp. 13-19, Fall, 1999.

"An Integrated Route to Engineering", Directions, Thayer School of Engineering, Vol **13**, No. 2, pp12-16, Spring, 1999. By Ellen Frye. [about IMPS microfabrication lab developed by C. Levey]

THAYER SCHOOL PLANNING DOCUMENTS

C. G. Levey, M. Franklin, K. Endicott, M. K. Brown, L. McKinnon, Thayer School Emergency Plan, Dartmouth College Thayer School of Engineering, July, 2009.

C. G. Levey, Instructional and Project Labs Status and Planning Document, Dartmouth College Thayer School of Engineering, June, 2009.

C. G. Levey, Thayer School Workshops Purpose and Guidelines: priority setting for the Instrument Room and Machine Shop, December 2007.

C. G. Levey, Instructional and Project Labs Status and Planning Document, Dartmouth College Thayer School of Engineering, May, 2003.

C. G. Levey, Research Laboratories Status, Dartmouth College Thayer School of Engineering, May, 2003.

C. G. Levey, Instructional and Project Labs Status and Planning Document, Dartmouth College Thayer School of Engineering, March 1999.

C. G. Levey, Thayer Board of Overseers Report: "Safety at Thayer School", October 16, 1998.

C. G. Levey, Initial Academic Computing Planning Document, Dartmouth College Thayer School of Engineering, November, 1997.

C. G. Levey, Instructional and Project Labs Status and Planning Document, Dartmouth College Thayer School of Engineering, November, 1997.