

Laurene Tetard - Assistant Professor

12424 Research Parkway
Suite 481
Orlando, FL 32826

(407) 882-0128
email: laurene.tetard@ucf.edu

OBJECTIVE

Nanotechnology, Nanoscience

Research and development using physical science, spectroscopy and scanning probe microscopy to advance the level of understanding of the behavior of soft matter and complex systems based on morphological, subsurface, physical and chemical properties at the submicrometer scale.

EDUCATION

<i>Ph.D.</i> in Physics University of Tennessee, Knoxville, TN, USA	2010
<i>M.S.</i> in Physics University of Burgundy, Dijon, France Concentration: Nanotechnologies and Nanosciences	2006
<i>B.S.</i> in Physics and Chemistry University of Burgundy, Dijon, France	2004

EXPERIENCE

Assistant Professor University of Central Florida, Orlando, FL, USA Nanoscience Technology Center	2013 - present
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Eugene P. Wigner Fellow and Research Staff Oak Ridge National Laboratory, Oak Ridge, TN, USA	2011 - 2013
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NANOMECHANICS AND NANOSPECTROSCOPY FOR SOFT MATTER

- Scanning probe microscopy (SPM): atomic force microscopy (AFM), near-field scanning optical microscopy (NSOM), etc.
- Spectroscopy (ultraviolet-visible, infrared, Raman),
- Setup of a new SPM and optics lab,
- Design of experiments involving SPM and spectroscopy, interfacing, data acquisition.
- Studied systems: plant tissues (stem, petiole, poplar cross-sections, spheroplasts, switchgrass residues, etc.), nanoparticles (gold spheres and rods, silica sphere, carbon nanohorns, etc.), cells and tissues, proteins, micro and nanostructures (cantilevers, bridges, matrices of dots and lines, etc.).

Graduate Research Assistant Oak Ridge National Laboratory, Oak Ridge, TN, USA	2007 - 2010
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NOVEL APPROACH FOR SPECTROSCOPIC MEASUREMENTS AT THE NANO-SCALE

- Scanning probe microscopy (SPM): atomic force microscopy (AFM), near-field scanning optical microscopy (NSOM), etc.
- Spectroscopy (ultraviolet-visible, infrared, Raman),
- Setup of a new SPM and optics lab,
- Design of experiments involving SPM and spectroscopy, interfacing, data acquisition.

- Studied systems: plant tissues (stem, petiole, poplar cross-sections, spheroplasts, switchgrass residues, etc.), nanoparticles (gold spheres and rods, silica sphere, carbon nanohorns, etc.), micro and nanostructures (cantilevers, bridges, matrices of dots and lines, etc.).

Post-Master

September - December 2006

Laboratoire d'Optique Submicronique, University of Burgundy, Dijon, France

DESIGN AND FABRICATION OF EMBEDDED NANOSTRUCTURES FOR NOVEL SPM IMAGING TECHNIQUES

- Fabrication of arrays of nanostructures in multilayered substrates: scanning electron microscopy, e-beam lithography, thermal and e-beam evaporation, reactive ion etching, clean-room,
- Preparation of assembled layers of nanoparticles such as dimers for near-field optical measurements.

Internship (M. S.-Year 2)

February - July 2006

Oak Ridge National Laboratory, Oak Ridge, TN, USA

IMAGING NANOPARTICLES IN CELLS BY NANOMECHANICAL SPM TECHNIQUES

- Setup of a new SPM and optics lab,
- Instrumentation towards nanomechanical imaging,
- Micro-Raman spectroscopy on carbon and silica nanoparticles,
- Studied systems: biological samples (macrophages and red blood cells, bone tissues), nanoparticles, polymers, etc.

Graduate Research Assistant (M. S.-Year 1)

September - December 2005

Laboratoire d'Optique Submicronique, University of Burgundy, Dijon, France

DEVELOPMENT OF NOVEL ELECTRODES FOR MANIPULATION AND ELECTROPORATION OF SINGLE BIOLOGICAL CELLS

- Fabrication of electrodes: scanning electron microscopy and atomic force microscopy, e-beam and UV lithography, polymers, thermal evaporation, reactive ion etching.
- Proof of principle: manipulation of U937 cells, and electroporation of DNA under fluorescence microscope for real-time monitoring.

PROFESSIONAL ACTIVITIES, HONORS AND AWARDS

- **Special Performance Award Recognition** for the establishment of the 1st Postdoctoral Research Symposium, Oak Ridge National Laboratory, August 2013.
- **Eugene P. Wigner Fellowship** Department of Energy and Oak Ridge National Laboratory, 2011-2013.
- **Finalist of the NIH Early Independence Award** 2011.
- **R&D100 Award** for development of Mode Synthesizing Atomic Force Microscope (MSAFM), 2010.
- **Chancellor's Honors, Extraordinary Professional Promise**, University of Tennessee, Knoxville, TN, USA, 2010.
- **Humboldt Kolleg student award**, invited oral and poster presentation, Roanoke, VA, USA, 2009.
- **Sigma Pi Sigma honoree**, Physics honor society, University of Tennessee Chapter, Knoxville, TN, USA, 2008.
- **Rotary Club scholarship** sponsoring internship abroad, Rotary Club, Dijon, France, 2006.
- **Academic scholarship**, University of Burgundy, Dijon, France, 2006.

- **Conference student award**, Nanofair 2005 New Ideas for Industry, International Nanotechnology Symposium, Dresden, Germany, 2005.

SYNERGISTIC ACTIVITIES

- **2013-present**: Conference organizer for the Material Research Society (MRS) - Spring 2014, Fall 2014;
- **2013**: Organizing committee of the 1st ORNL Postdoc Research Symposium (over 400 attendees), Oak Ridge National Laboratory;
- **2012-present**: Reviewer for Nature Physics, Physical Review Letters, Scientific Reports, Physical Review E, Ultramicroscopy, International Journal of Optics, Applied Physics Letters;
- **2013**: Volunteer and invited panel member at the high school "Science Saturdays" series organized by Oak Ridge National Laboratory and Oak Ridge Associated Universities (ORAU);
- **2013**: Invited guest at the L&N Academy Network event for women in STEM;
- **2012-2013**: Mentorship program for graduate fellows from the Bredesen Center for Interdisciplinary Research and Graduate Education (CIRE) program, Oak Ridge National Laboratory/Partner Universities;
- **2012-2013**: Seminar series for graduate fellows from the Bredesen Center for Interdisciplinary Research and Graduate Education (CIRE) program, Oak Ridge National Laboratory/University of Tennessee;
- **2012**: Invited Panel member at the Southern conference for undergraduate women in physics, University of Tennessee;
- **2003-2006**: Tutoring science for elementary, middle and high-school students from inner cities schools, Dijon, France;

COLLABORATIONS

- **BioEnergy Science Center**
- **US and Canada**: Prof. T. Thundat (University of Alberta, Canada), Prof. D. Mukherjee (University of Tennessee), Dr. M. Yazdanpanah (Nauganeedles), Dr. L. Petridis (Oak Ridge National Laboratory), Dr. V. Paquit (Oak Ridge National Laboratory), Dr. H. Santos (Oak Ridge National Laboratory), Prof. A. Raman (Purdue University), Dr. B. Davison (Oak Ridge National Laboratory), Prof. N. Labbe (University of Tennessee), Dr. M. Foston (Washington University, St Louis)
- **International**: Dr. A. Lereu (CNRS, Marseille, France), Prof. E. Lesniewska (CNRS, Dijon, France), Dr. M. Ewald (University of Reims, France), Prof. M. Castro (University of Puerto Rico Mayaguez), Dr. E. Ferrer Torres (Inter American University, Ponce, Puerto Rico)

GRADUATE AND UNDERGRADUAE STUDENTS DIRECTED

- **2012-2013**: Patrick Snyder (University of Illinois);
- **2011**: Lisa Agle (University of Tennessee); Caleb Redding (University of Tennessee); Steven Crawford (University of Tennessee); Julio Irizarry (Polytechnic University of Puerto Rico); Daniel Webster (Polytechnic University of Puerto Rico);
- **2010**: Katherine Nadler (University of California San Diego);
- **2009**: Jeremy Nabeth (Purdue University);
- **2008**: Marissa Morales (University of Puerto Rico);
- **2007**: Desiree Smith (University of California, Riverside).

ADVANCED TECHNICAL SKILLS

High resolution microscopy

Atomic Force microscopy (AFM), Ultrasonic Force Microscopy (UFM), Mode Synthesizing Atomic Force Microscopy (MSAFM), Scanning Near-Field Ultrasonic Holography (SNFUH), Near-Field Scanning Optical Microscopy (NSOM), Scanning Electron Microscopy (SEM).

Spectroscopy

FT-IR and infrared spectroscopy, Raman spectroscopy, ultraviolet-visible spectroscopy.

Instrument interfacing, data acquisition and automation

Labview, Igor, Matlab.

Software and programming languages

- **Interfacing and Data acquisition:** Matlab, Igor, Labview
- **Data Processing:** Matlab, Igor, IDL, Mathematica, C/C++, Fortran
- **Graphics and design:** LateX, Photoshop, Canvas, Illustrator, Strata 3D
- **Other utilities:** html, iweb, AutoDesk

TEACHING EXPERIENCE

- Supervising high school, undergraduate, master and post-master students from various programs supported through Oak Ridge Associated Universities (ORAU) and Oak Ridge Institute for Science and Education (ORISE). 2007 - Present
- Tutoring Mathematics and Physics for undergraduate students. 2003 - 2006
- Tutoring science for elementary, middle, and high-school students. Confederation Syndicale des Familles, Dijon, France 2003 - 2006

PATENTS

- L.Tetard, A. Passian, B. Davison, T. Thundat. Scanning probe microscopy with spectroscopic molecular recognition, 2008 (pending).
- L.Tetard, A. Passian, T. Thundat. Mode synthesizing atomic force microscopy and mode synthesizing sensing, 2009 (Patent number US8448261 B2, issued in 2013).

PUBLICATIONS

Published

- P. Chantharasupawong, R. Philip, L. Tetard, L. Zhai, J. Winiarz, M. Yamamoto, R. R. Nair, J. Thomas. Graphene: A promising Sensitizer for Photorefractive Polymers, under review with Advanced Materials, December 2013.
- B. Duong, H. Khurshid, P.Gangopadhyay, J. Devkota, K. Stojak, H. Srikanth, L. Tetard, R.A. Norwood, N. Peyghambarian, M.-H. Phan, J. Thomas. Enhanced Magnetism in Highly Ordered Magnetite Nanoparticle-filled Nanohole Arrays, under review with Advanced Functional Materials, November 2013.
- M. Ewald, L. Tetard, C. Elie-Caille, L. Nicod, A. Passian, E. Bourillot, E. Lesniewska. Non-invasive observation of intracellular impairments in live epidermal cells with nanoscale resolution, under review with NanoResearch, December 2013.
- L. Tetard, A. Passian, R. H. Farahi, T. Thundat, B. H. Davison. Opto-nanomechanical spectroscopic imaging, under review with Nature Nanotechnology, July 2013.
- A. Passian, L. Tetard, T. Thundat. Comments on the paper A comprehensive modeling and vibration analysis of AFM microcantilevers subjected to nonlinear tip-sample interaction forces by Sohrab Eslami and Nader Jalili. **Ultramicroscopy**, 131, 92-93, 2013.
- A. Lereu, R. H. Farahi, L. Tetard, S. Enoch, T. Thundat, A. Passian. Plasmon assisted thermal modulation in nanoparticles. **Optics Express**, 21 (10), 12145-12158, 2013.

- R. H. Farahi, V. Zaharov, L. Tetard, T. Thundat, A. Passian. Data Analysis of Multi-Laser Standoff Spectral identification of chemical and biological compounds. Micro- and Nanotechnology Sensors, Systems, and Applications V, edited by Thomas George, M. Saif Islam, Achyut K. Dutta. **Proc. of SPIE** Vol. 8725, 87252A, 2013. doi: 10.1117/12.2018418
 - L. Tetard, A. Passian, S. Jung, A. J. Ragauskas, B. H. Davison. Development of New Methods in Scanning Probe Microscopy for Lignocellulosic Biomass Characterization, **Industrial Biotechnology**, 8, 1, 2012.
 - R. H. Farahi, A. Passian, L. Tetard, T. Thundat. Critical issues in sensor science to aid food and water safety, **ACS Nano**, 6, 4548, 2012.
 - R. H. Farahi, A. Passian, L. Tetard, T. Thundat. Pump-probe photothermal spectroscopy using quantum cascade lasers, **Journal of Physics D-Applied Physics**, 45, 125101, 2012.
 - A. Lereu, A. Passian, R. H. Farahi, L. Abel-Tiberini, L. Tetard, T. Thundat. Spectroscopy and imaging of arrays of nanorods toward nanopolarimetry, **Nanotechnology**, 23, 045701, 2012.
 - L. Tetard, A. Passian, S. Eslami, N. Jalili, R. H. Farahi, T. Thundat. Virtual resonance and frequency difference generation by van der Waals interaction, **Physics Review Letters**, 106, 180801, 2011.
 - L. Tetard, A. Passian, R. H. Farahi, B. H. Davison, T. Thundat. Optomechanical spectroscopy with broadband interferometric and quantum cascade laser sources, **Optics Letters**, 36, 3251-3253, 2011.
 - L. Tetard, A. Passian, R. H. Farahi, B. H. Davison, A. L. Lereu, T. Thundat. Optical and plasmonic spectroscopy with cantilever shaped materials, **Journal of Physics D**, 44, 445102, 2011.
 - L. Tetard, A. Passian, R. H. Farahi, B. H. Davison, S. Jung, A. J. Ragauskas, A. L. Lereu, T. Thundat. Nanometrology of delignified Populus using mode synthesizing atomic force microscopy, **Nanotechnology**, 22, 465702, 2011.
 - L. Tetard, A. Passian, T. Thundat. New modes for subsurface atomic force microscopy through nanomechanical coupling, **Nature Nanotechnology**, 5, 105-109, 2010.
 - L. Tetard, A. Passian, R. H. Farahi, T. Thundat. Atomic force microscopy of silica nanoparticles and carbon nanohorns in macrophages and red blood cells, **Ultramicroscopy**, 110, 586-591, 2010.
 - L. Tetard, A. Passian, R. H. Farahi, U. C. Kalluri, B. H. Davison, and T. Thundat. Spectroscopy and atomic force microscopy of biomass, **Ultramicroscopy**, 110, 701-707, 2010.
 - R. Farahi, A. Passian, Y. K. Jones, L. Tetard, A. L. Lereu, T. Thundat. Laser reflectometry of submegahertz liquid meniscus ringing, **Optics Letters**, 34 (20), 3148-3150, 2009.
 - S. Eslami, N. Jalili, A. Passian, L. Tetard, T. Thundat. Nonlinear interaction force analysis of microcantilevers utilized in atomic force microscopy, Proceedings of the ASME dynamic systems and control conference 2009 PTS A and D, 781-788, 2010.
 - L. Tetard, A. Passian, K. T. Venmar, R. M. Lynch, B. H. Voy, G. Shekhawat, V. P. Dravid, T. Thundat. Imaging nanoparticles in cells by nanomechanical holography, **Nature Nanotechnology**, 3, 501-505, 2008.
 - L. Tetard, A. Passian, R. M. Lynch, B. H. Voy, G. Shekhawat, V. P. Dravid, T. Thundat. Elastic phase response of silica nanoparticles buried in soft matter, **Applied Physics Letters**, 93, 133113, 2008.
- Book Chapters**
- R. Desikan, L. Tetard, A. Passian, R. Datar, and T. Thundat. Nanomechanical methods to study single cells. In K. Zengler (Ed.), *Accessing Uncultivated Microorganisms: from the Environment to Organisms and Genomes and Back*. Washington, D.C.: ASM Press, 2009.
 - L. Tetard, A. Passian, R. H. Farahi, B. H. Voy, T. Thundat. Applications of Subsurface Microscopy, Nanotoxicity, in *Methods in Molecular Biology*, vol. 926, 2012.

PRESS COVERAGE

News and Views in Nature Nanotechnology, R&D Magazine, Department of Energy highlights, NCI highlights, Spectroscopy now, Genetic Engineering and Biotechnology News (GEN), SciGuru Science News, Imaging and Microscopy, Materials Today, Nanowerk, Azosensors, Homeland Security News Wire, Nanotechnology Business Journal, Quest by the University of Tennessee Knoxville.

CONFERENCES AND WORKSHOPS

Oral presentations

- L. Tetard (Invited seminar). New modalities of nanomechanical and nanochemical characterization of soft matter and complex systems. University of Central Florida, November 2013.
- L. Tetard (Invited). Workshop on Data Collection, Analysis and Modeling of Nano-particle/Cell Interactions for Cancer Research. University of Central Florida, October 2013.
- L. Tetard (Invited seminar). New modalities of atomic force microscopy for the physical and chemical exploration of complex systems at the nanoscale. University of California San Diego, CA, March 2013.
- L. Tetard (Invited seminar). New modalities of nanomechanical and nanochemical characterization of complex systems to tackle disease-related and nanotoxicity challenges. University of Central Florida, Orlando, FL, December 2012.
- L. Tetard (Invited seminar). New modalities of atomic force microscopy for the physical and chemical exploration of complex systems at the nanoscale. Department of Energy, Environmental & Chemical Engineering, Washington University, St Louis, MO, November 2012.
- L. Tetard (Invited), A. Passian, B.H. Davison. Surface and subsurface physical and chemical characterization of soft materials at the nanoscale. 2012 Frontiers in Biorefining Conference, St Simons Island, GA, October 2012.
- L. Tetard, A. Passian, B.H. Davison. Investigating lignocellulosic biomass at the nanoscale. BioEnergy Science Center retreat, Oak Ridge, TN, August 2012.
- T. Thundat (Invited), A. Passian, L. Tetard. Photothermal cantilever deflection spectroscopy, International Scanning Probe Microscopy Conference, Toronto, Ontario, Canada, June 2012.
- L. Tetard (Invited), A. Passian, B.H. Davison. Spatio-chemical characterization of biomass, BioEnergy Science Center, Riverside, CA, January 2012.
- L. Tetard (Invited), A. Passian, R.H. Farahi, B.H. Davison, T. Thundat. Surface and subsurface physical and chemical characterization of materials at the nanoscale, MRS meeting, Boston, MA, December 2011.
- L. Tetard, A. Passian. Subsurface high resolution imaging for soft matter, Workshop: Understanding the organization of the intracellular region, Memphis, TN, June 2011.
- L. Tetard (Invited). Surface and subsurface physical and chemical characterization of materials at the nanoscale, Centre Interdisciplinaire de Nanoscience de Marseille (CINaM), Marseille, France, January 2011.
- L. Tetard (Invited). Surface and subsurface physical and chemical characterization of materials at the nanoscale, Institut d'Electronique, Microelectronique, et Nanotechnologies (IEMN), Lille, France, December 2010.
- L. Tetard (Invited). Surface and subsurface physical and chemical characterization of materials at the nanoscale, Oak Ridge National Laboratory, Oak Ridge, TN, December 2010.
- L. Tetard (Invited), A. Passian, U. Kalluri, B. Davison, M. Keller, T. Thundat. A novel approach for biomass measurements at the nanoscale, BioEnergy Science Center, Riverside, CA, January 2010.
- L. Tetard, A. Passian, T. Thundat. Mechanisms of subsurface force microscopy on biological samples, Humboldt Kolleg, Roanoke, Virginia, October 2009.
- L. Tetard (Invited), A. Passian, U. Kalluri, B. Davison, M. Keller, T. Thundat. Novel approach for biomass measurements at the nanoscale, BioEnergy Science Center, Asheville, NC, June 2009.
- L. Tetard, A. Passian, U. Kalluri, B. Davison, M. Keller, T. Thundat. Novel approach for biomass

surface measurements at the nanoscale, BioEnergy Science Center, National Renewable Energy Laboratory, Denver, CO, 2008.

- B. M. Lynch, B. H. Voy, D. F. Glass, S. M. Mahurin, B. Zhao, L. Tetard, A. Passian, K. T. Venmar, T. Thundat, M.D. Cheng. In-vivo exposure characterization and visualization of single walled carbon nanohorn aggregates. Third International Symposium on Nanotechnology, Occupational and Environmental Health, Taipei, Taiwan, September 2007.

- L. Tetard. Imaging nanoparticles in cells by nanomechanical holography, University of Burgundy, Dijon, France, September 2007.

Poster Presentations

- L. Tetard. Investigating lignocellulosic biomass at the nanoscale. 2012 Bredesen Center Speed Networking Event for the University of Tennessee, Oak Ridge, TN, August 2012.

- P. Snyder, L. Tetard. Synthesizing new modes of force microscopy for nanomechanical study. SULI program, Oak Ridge, TN, August 2012.

- L. Tetard, A. Passian, B.H. Davison. Investigating lignocellulosic biomass at the nanoscale. BioEnergy Science Center retreat, Chattanooga, TN, July 2012.

- L. Tetard, A. Passian, R. H. Farahi. Surface and subsurface physical and chemical characterization of materials at the nanoscale. Nature Winter Symposium: Nanotechnology in Biomedicine, Miami, FL, February 2012.

- L. Tetard, A. Passian, B.H. Davison, P. Gilna. High Resolution Characterization of Biomass. 2012 Genomic Science Awardee Meeting X, Bethesda, MD, February 2012.

- A. Passian, R. H. Farahi, L. Tetard, A. Lereu, S. Gleason. Nanoplasmonics in energy and biomedical research. Future of Instrumentation workshop, Oak Ridge, TN, November 2011.

- L. Tetard, A. Passian, B.H. Davison. High resolution characterization of biomass. BioEnergy Science Center retreat, Chattanooga, TN, July 2011.

- L. Tetard, A. Passian, R. H. Farahi, A. Lereu, S. Gleason, A. Lereu, K. W. Tobin. Trends in high spatial high spectra resolution material characterization. Future of Instrumentation workshop, Oak Ridge, TN, November 2011.

- A. Passian, A.Lereu, P. Dumas, R. H. Farahi, L. Tetard, M. Garcia-Parajo, N. van Hulst. Evolution of near field microscopy. Future of Instrumentation workshop, Oak Ridge, TN, November 2011.

- L. Tetard, A. Passian, R. H. Farahi, T. Thundat. Fourier transform infrared spectroscopy using mechanical oscillators, Nanomechanical Cantilever Sensor Conference, Canada, May 2010.

- L. Tetard, A. Passian, R. H. Farahi, A. Lereu, T. Thundat. Fourier transform infrared spectroscopy using mechanical oscillators, International Scanning Probe Microscopy Conference, Japan, May 2010.

- L. Tetard, A. Passian, R. H. Farahi, A. Lereu, T. Thundat. Mode synthesizing atomic force microscopy of plant cells, International Scanning Probe Microscopy Conference, Japan, May 2010.

- A. Lereu, A. Passian, R. H. Farahi, Ph. Dumas, L. Tetard, T. Thundat. Near-field excitation and polarization dependence of single nanorods, International Scanning Probe Microscopy Conference, Japan, May 2010.

- R. H. Farahi, A. Passian, A. L. Lereu, L. Tetard, T. L. Ferrell, T. Thundat. Nanoparticle thermo-plasmonic modulation , International Scanning Probe Microscopy Conference, Japan, May 2010.

- L. Tetard, A. Passian, T. Thundat. Underlying physical principles of subsurface force microscopy, American Physical Society (APS) Meeting, Portland, OR, March 2010.

- L. Tetard, A. Passian, U. Kalluri, B. Davison, M. Keller, T. Thundat. Novel approach for biomass surface measurements at the nanoscale, BioEnergy Science Center, Oak Ridge National Laboratory, Oak Ridge, TN, October 2009.

- L. Tetard, A. Passian, T. Thundat. Mechanisms of subsurface force microscopy on biological samples, Humboldt Kolleg, Roanoke, Virginia, October 2009.

- L. Tetard, A. Passian, U. Kalluri, B. Davison, M. Keller, T. Thundat. Novel approach for biomass

measurements at the nanoscale, BioEnergy Science Center, Asheville, NC, June 2009.

- L. Tetard, A. Passian, R. H. Farahi, S. Jung, B. Davison, U. Kalluri, A. Ragauskas, and T. Thundat. Characterization of biomass at the nanoscale, International Scanning Probe Microscopy Conference, Madrid, Spain, June 2009.

- L. Tetard, A. Passian, R. H. Farahi, T. Thundat. Scanning probe microscopy of nanoparticles in biological cells, International Scanning Probe Microscopy Conference, Spain, June 2009.

- L. Tetard, A. Passian, U. Kalluri, B. Davison, M. Keller, T. Thundat. Novel approach for biomass surface measurements at the nanoscale, BioEnergy Science Center, Chattanooga, TN, 2008.

Workshops

- Bioenergy Science Center (BESC), Riverside, CA, January 2012.

- Future of instrumentation workshop, Oak Ridge, TN, November 2011.

- Future of instrumentation workshop, Oak Ridge, TN, November 2010.

- Birck Nanotechnology Center, Purdue University, West Lafayette, IN, March 2010.

- Bioenergy Science Center (BESC), Riverside, CA, January 2010.

- Anasys Instrument, University of California Santa Barbara, Santa Barbara, CA, May 2009.

- Bioenergy Science Center (BESC), National Renewable Energy Laboratory (NREL), Golden, CO, January 2009.

- Atomic and Nanoscale Characterization Experimental Center (NUANCE), Northwestern University, Evanston, IL, 2006.