

Laurene Tetard, Eugene P. Wigner Fellow

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OBJECTIVE

Nanotechnology, Nanoscience

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

EDUCATION

<i>Ph.D.</i> in Physics	2010
University of Tennessee, Knoxville, TN, USA	
<i>M.S.</i> in Physics	2006
University of Burgundy, Dijon, France	
Concentration: Nanotechnologies and Nanosciences	
<i>B.S.</i> in Physics and Chemistry	2004
University of Burgundy, Dijon, France	
<i>CPGE-MP Classes Préparatoires aux Grandes Ecoles</i>	2002 - 2003
Preparation for the competitive entrance examinations to science and engineering schools Part II	
Lycee Chrestien de Troyes, Troyes, France	
Concentration: Mathematics and Physics	
<i>CPGE-MPSI Classes Préparatoires aux Grandes Ecoles</i>	2001 - 2002
Preparation for the competitive entrance examinations to science and engineering schools Part I	
Lycee Chrestien de Troyes, Troyes, France	
Concentration: Mathematics, Physics and Mechanical Engineering	

EXPERIENCE

<i>Eugene P. Wigner Fellow</i>	2011 - Present
Oak Ridge National Laboratory, Oak Ridge, TN, USA	

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.).

<i>Graduate Research Assistant</i>	2007 - 2010
Oak Ridge National Laboratory, Oak Ridge, TN, USA	

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 (Master-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.

Internship (Master-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.

HONORS AND AWARDS

- **Conference student award**, Nanofair 2005 New Ideas for Industry, International Nanotechnology Symposium, Dresden, Germany, 2005.
- **Academic scholarship**, University of Burgundy, Dijon, France, 2006.
- **Rotary Club scholarship** sponsoring internship abroad, Rotary Club, Dijon, France, 2006.
- **Sigma Pi Sigma honoree**, Physics honor society, University of Tennessee Chapter, Knoxville, TN, USA, 2008.
- **Humboldt Kolleg student award**, invited oral and poster presentation, Roanoke, VA, USA, 2009.
- **Chancellor's Honors, Extraordinary Professional Promise**, University of Tennessee, Knoxville, TN, USA, 2010.

- **R&D100 Award** for development of Mode Synthesizing Atomic Force Microscope (MSAFM), 2010.
- **Eugene P. Wigner Fellowship** 2011-2013.

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 (pending).

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

PUBLICATIONS

Published

- 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.
- 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, 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.
- 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, 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, T. Thundat. Optomechanical spectroscopy with broadband interferometric and quantum cascade laser sources, **Optics Letters**, 36, 3251-3253, 2011.
- 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.
- 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.
- 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.
- 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.
- 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.

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.

CONFERENCES AND WORKSHOPS

Oral presentations

- 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.