

Centenary College of Louisiana  
Department of Physics  
2911 Centenary Blvd.  
Shreveport, LA 71104

t: 318.869.5217  
c: 318.828.5487  
e: tmessina@rci.rutgers.edu  
[www.centenary.edu/physics/tmessina](http://www.centenary.edu/physics/tmessina)

## EDUCATION

University of Texas at Austin, Ph.D., Condensed Matter Physics, December 2002  
University of Texas at Austin, M.A., Condensed Matter Physics, December 1999  
University of Texas at Austin, B.S., Physics, May 1996

## EXPERIENCE

### *Assistant Professor of Physics*

August 2007 – present

### **Centenary College of Louisiana**

Shreveport, LA

I am an assistant professor of physics and chair of engineering at a liberal arts college in Shreveport, LA. The college maintains a high level of research goals involving undergraduates in addition to traditional liberal arts education, with a student to teacher ratio of twelve across the college. Our department develops the latest pedagogical techniques, e.g., inquiry and experienced based learning. Centenary College also has one of the first biophysics degree programs introduced at a liberal arts institution. See <http://www.centenary.edu/physics/tmessina>.

### *NIH NRSA Post-Doctoral Research Fellow*

September 2003 – August 2007

### **Rutgers, the State University of New Jersey**

Piscataway, NJ

My primary interest is to understand how the diversity of conformation and structure in complex molecules and materials contribute to and modify their function. Single molecule spectroscopy, and specifically, time-correlated single photon counting (TCSPC) with femto- and picosecond pulsed lasers allow me to observe these molecules as they thermally fluctuate through their conformational states. Both bulk and single molecule fluorescence, rotational anisotropy, and Stokes shift provide detail about molecular motions due to solvation, ligand-binding, and protein folding/fluctuations. These experiments make use of thoughtful fluorescent labeling schemes and micro- and nanofluidics for confinement of molecules to the microscope confocal volume without hindering natural behavior. I have made the first implementation of hidden Markov model (HMM) analysis on photon streams to maximize use of the information provided. See <http://talaga.rutgers.edu>.

### *Post-Doctoral Research Associate*

February 2003 – September 2003

### **Princeton University**

Princeton, NJ

I developed electronic sensing techniques for biological discrimination without the need for chemical or physical sample alteration. Microfluidic tectonics was used to create novel parallel-plate devices for dielectric spectroscopy of biological materials (e.g., DNA, proteins, and E. coli cells) over the range 0.05-40 GHz. Other research was aimed at multi-analyte detection for binding assays of molecular and cellular biological materials using the Coulter resistive pulse technique. See <http://sohnlab.me.berkeley.edu>.

### *Graduate Research Assistant*

January 1997 – January 2003

### **The University of Texas at Austin**

Austin, TX

Yttrium and lanthanum were discovered in 1996 to transition from a metallic mirror to a transparent insulator upon hydrogenation to the trihydride phase ( $\text{YH}_3$  and  $\text{LaH}_3$ ). I have looked into steric effects upon this transition by substituting isoelectronic scandium for yttrium. Scandium maximally forms dihydride ( $\text{ScH}_2$ ), and therefore, does not exhibit this transition. My experience includes ultra-high vacuum (UHV), electron beam, thermal, and sputtering film deposition, optical spectroscopy, SQUID magnetometry, electronic transport measurements, NMR, AFM, SEM, x-ray diffraction, iodometric titration, solid-state reaction, and thermal gravimetric analysis (TGA). A pdf of my dissertation, "Steric Effects in the Metallic-Mirror to Transparent Insulator Transition of  $\text{YH}_x$ " can be downloaded at <http://www.themessinas.net/dissertation.pdf>.

### *Semiconductor Industry Intern*

June 1997 – April 2002

### **International Sematech/I300I**

Austin, TX

I conducted research as an intern for the International 300mm Initiative (I300I) and International Sematech (ISMT) in parallel with my dissertation studies. These companies are consortia from the semiconductor industry to eliminate cost-bearing and technological obstacles within the industry. Research included analysis of production capability of 300 mm silicon wafers and metrology tools as compared to state-of-the-art 200 mm technology, developing mathemat-

ical models for the International Technology Roadmap for Semiconductors (ITRS) Starting Materials division, and thermal stability and wet etch capability of high- $\kappa$  dielectric materials ( $ZrO_2$  and  $HfO_2$ ) to replace  $SiO_x$ . Wet etch studies enabled ISMT to file for a patent on the film removal process. The techniques used include FTIR, ellipsometry, ion implantation, and surface particle and flatness scanners. See <http://www.sematech.org>.

#### *Contract Engineer*

July 2000 – December 2001

Designed, constructed, and used a chemical vapor deposition (CVD) system for growth of carbon nanotubes (CNTs). CNTs were grown using a precursor catalyst method, and analyzed with scanning electron microscopy (SEM). Growth conditions were tailored to obtain single, straight CNT on an ultrasensitive crystal silicon cantilever for scanning force microscopy. See <http://www.xidex.com>.

#### **Xidex Corporation**

Austin, TX

## TEACHING

- *Modern Physics, Thermal Physics, Advanced Physics Laboratory*, Centenary College, 2007–08
- *Experience-Based Education Mentor*, Rutgers University 2004–06
- *Research In Science and Engineering (R.I.S.E.) Mentor*, Rutgers University 2005
- *Physics II Laboratory*, University of Texas, 2000–01
- *Physics I Laboratory*, University of Texas, 1998–99
- *Physics for Poets*, University of Texas, 1997
- *Pseudoscience*, University of Texas, 1997
- *Mathematics Grader, Calculus I – II*, University of Texas, 1995–96

## HONORS/AWARDS

- Zeta Tau Alpha Professor of the Month, February 2008
- Broyle's Inaugural Year Research Chair, 2007–08
- NIH Ruth L. Kirschstein NRSA Post-Doctoral Fellowship, 2004–07
- Rutgers Molecular Biophysics Minisymposium Poster Prize, 2007
- Rutgers Molecular Biophysics Minisymposium Poster Prize, 2006
- Best Student Paper Award, SPIE 2001: MEMS Components and Applications to Industry, 2001

## SKILLS

- *Biology* Molecular Cloning, PCR, Fluorescent Labeling, FPLC, HPLC, Gel Electrophoresis
- *Programming Languages*: C, C++, Igor Pro, IDL, Basic, HTML, CSS, Flash
- *Tools*: Ultra-High Vacuum, Thin Film Deposition (sputtering, e-beam, thermal, CVD), AFM, SEM, Ellipsometry, SQUID Magnetometry, Time-Correlated Single Photon Counting, Confocal Microscopy, FTIR, Electronic Transport
- *Operating Systems*: MacOS X, Linux, Windows
- *Software*: Hidden Markov Model (HMM) software for TCSPC in C++ and Igor Pro (<http://www.singlemolecule.net>)

## EXTRAMURAL

- Semi-professional Drummer, 1991 – present
- Triathlons, Running, Swimming, Cycling, 1994 – present
- Organic Gardening, 1997 – present

## PUBLICATIONS

1. C. W. Miller, M. D. Chabot, and T. C. Messina, "A Student's Guide to Searching the Literature via Internet Databases", *submitted to Am. J. Phys.* (2008).
2. T. C. Messina, D. S. Talaga, E. Gallichio, and R. M. Levy, "Molecular Dynamics Simulation of the Ligand-Modulated Free Energy Landscapes of Glucose/Galactose Binding Protein", *in preparation* (2008).
3. C.-Y. Huang, T. C. Messina and D. S. Talaga, "Reconstruction of Single Molecule Langevin Dynamics using Hidden Markov Models", *in preparation* (2008).
4. T. C. Messina and D. S. Talaga, "Protein free energy landscapes remodeled by ligand binding", *Biophys. J.* **93**, 579-585 (2007).
5. T. C. Messina, C. W. Miller, and J. T. Markert, "Steric quenching of the switchable mirror effect", *Phys. Rev. B* **75**, 104109 (2007).
6. T. C. Messina, H. Kim, J. T. Giurleo, and D. S. Talaga, "Hidden Markov Model Analysis of Multichromophore Photobleaching", *J. Phys. Chem. B* **110**, 16366-16376 (2006).
7. J.-H. Choi, T. C. Messina, J. Yan, G. I. Drandova, and J. T. Markert, "Thermal Conductivity and  $^{89}\text{Y}$  NMR of  $\text{Ca}_{2+x}\text{Y}_{2-x}\text{Cu}_5\text{O}_{10}$ ", *J. of Magn. Mag. Mat.* **272**, 970-971 (2004).
8. T. C. Messina, L. N. Dunkleberger, G. A. Mensing, A. S. Kalmbach, R. Weiss, D. Beebe, and L. L. Sohn, "A Novel High-Frequency Sensor for Biological Discrimination", in the International Conference on Miniaturized Chemical and Biochemical Analysis Systems 2003, Kluwer Academic Publishers (2003).
9. C. W. Miller, U. Mirsaidov, T. C. Messina, J. T. Markert, "External Field Effects on Characteristics of Magnetically-Capped Oscillators for Magnetic Resonance Force Microscopy", *J. App. Phy.* **93**, 6572 (2003).
10. T. C. Messina, C. W. Miller, J. T. Markert, "Steric Effects in the Metal-Insulator (Mirror-Transparent) Transition in  $\text{YHx}$ ", *J. Alloys and Compounds* **356-357**, 181 (2003).
11. J. T. Markert, T. C. Messina, B. Dam, J. Huijbregste, J. H. Rector, and R. Griessen, "Infinite-Layer Copper-Oxide Laser-Ablated Thin Films: Substrate, Buffer-Layer, and Processing Effects", *IEEE Transactions on Applied Superconductivity*, **13**, 2684 (2003).
12. G. I. Drandova, T. C. Messina, J. T. Markert, "NMR of  $^{89}\text{Y}$  in the Copper-Oxide Spin-Chain Compound  $\text{Ca}_{2+x}\text{Y}_{2-x}\text{Cu}_5\text{O}_{10}$ ", *J. Low Temperature Physics* **131**, 305 (2003).
13. K. Mochizuki, J.-H. Choi, T. C. Messina, Y. Ando, K. Nakamura, J. T. Markert, "Extreme Smallness of the Transverse Force on Moving Vortices", *Physica C* **388-389**, 705 (2003).
14. J. Barnett, D. Riley, T. Messina, P. Lysaght, "Wet Etch Enhancement of  $\text{HfO}_2$  Films by Implant Processing", *Solid State Phenomena* **92**, 11 (2003).
15. P. S. Lysaght, P. J. Chen, R. Bergmann, T. Messina, R. W. Murto and H. R. Huff, "Experimental Observations of the Thermal Stability of High- $\kappa$  Gate Dielectric Materials on Silicon", *Journal of Non-Crystalline Solids* **303**, 54 (2002).
16. M. D. Chabot, T. C. Messina, V. Manicevski, C. W. Miller, J. T. Markert, "Single-Crystal Silicon Triple-Torsional Micro-Oscillators for Use in Magnetic Resonance Force Microscopy", *SPIE-Int. Soc. Opt. Eng. Proceedings of Spie - the International Society for Optical Engineering* **4559**, 24 (2001).
17. J. T. Markert, T. C. Messina, B. Dam, J. Huijbregste, J. Rector, R. Griessen, "Observation of Step-Flow Growth in Laser-Ablated thin films of the T'-Phase compound  $\text{Pr}_2\text{CuO}_4$ ", *Physica C* **341-348**, 2355-56 (2000).
18. J. T. Markert, T. C. Messina, B. Dam, J. Huijbregste, J. H. Rector, R. Griessen, "Laser-Ablated Thin Films of Infinite-Layer Compounds and Related Materials", *Proceedings of SPIE* **4058**, 141 (2000).
19. T. Ono, G. A. Rozgonyi, C. Au, T. C. Messina, R. Goodall, H. R. Huff, "Oxygen Precipitation Behavior in 300mm Polished Czochralski Silicon Wafers", *J. Electrochem. Soc.* **146**, 3807 (1999).
20. H. R. Huff, D. McCormack Jr., C. Au, T. C. Messina, K. Chan, R. Goodall, "Current Status of 200mm and 300mm Silicon Wafers", *Proceedings of the Intl. Solid State Devices and Materials (ISSDM '97)*, Japan, p. 456 and Conference Abstracts p.575, (1997) also published in *Jpn J. Appl Phys* **37**, (1998) Pt.1, No.3B.

21. C. Au, T. C. Messina, R. Goodall, H. R. Huff, "Characterization of 300mm Polished Silicon Wafers", *Proceedings of the 8th International Symposium on Silicon Materials and Technology* **1**, p.641, (1998).
22. T. C. Messina, C. Au, S. Shih, Z. Yang, R. Goodall, H. R. Huff, "Current Status of 300mm Wafer Characterization", *Proceedings of the International Mechanical Engineering Conference and Exposition (IMECE '98)*, p.825, (1998).
23. S. Shih, C. Au, Z. Yang, T. C. Messina, R. Goodall, H. R. Huff, "Characterization of 300mm Silicon-Polished and Epi Wafers", *Microelectronic Engineering* **45**, 169 (1999).
24. J. T. Markert, K. Mochizuki, T. C. Messina, B. C. Dunn, A. V. Elliott, "Studies of Infinite-Layer, T'-Phase, and 1-D Ladder Copper-Oxide Compounds", *Physics and Materials Science of High Temperature Superconductor, IV. Proceedings of the NATO Advanced Research Workshop*, Kluwer Academic Publishers. 1997, pp.151.

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**INVITED TALKS**


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1. "Structure-Function Relationships in Proteins Observed Through Fluorescence and Computational Molecular Dynamics", American Chemical Society, Northwest Louisiana Section Local Meeting, Shreveport, LA, February 26, 2008.
2. "Relationships Between Protein Structure, Function, Folding, and Aggregation", Department of Chemistry Colloquium, University of Arkansas - Fayetteville, Fayetteville, AR, January 23, 2007.
3. "Relationships Between Protein Function, Structure, (Mis)Folding, and Aggregation", Department of Physics Colloquium, University of Alabama - Birmingham, Birmingham, AL, January 18, 2007.
4. "From functional, shallow conformational equilibria to dysfunctional, irreversible misfolding on protein free energy landscapes", Department of Physics Colloquium, University of Texas at Brownsville, Brownsville, TX, January 16, 2007.
5. "Structural roles in protein function, folding, misfolding, and aggregation", Centenary College Special Colloquium, Shreveport, LA, December 7, 2006.
6. "Structural roles in protein function, folding, misfolding, and aggregation", Special Colloquium, Department of Physics, University of Kansas, Lawrence, KS, November 30, 2006.
7. "Structural roles in protein function, folding, misfolding, and aggregation", University of Tennessee Space Institute Special Colloquium, Tullahoma, TN, November 27, 2006.
8. "Magnet-on-Oscillator Characterization for Nuclear Magnetic Resonance Force Microscopy", Rutgers, the State University of New Jersey, August 2003.
9. "Steric Effects on the Metallic-Mirror to Transparent-Insulator Transition in  $YH_x$ ", Special Colloquium, Department of Physics, University of Pennsylvania August 2003.
10. "Steric Effects on the Metallic-Mirror to Transparent-Insulator Transition in  $YH_x$ ", Special Colloquium, Department of Physics, University of Montana December 20, 2002.
11. "Steric Effects on the Metallic-Mirror to Transparent-Insulator Transition in  $YH_x$ ", Special Colloquium, Department of Physics, Princeton University, December 12, 2002.
12. "Electronic and Magnetic Transport Experiments in Condensed Matter", Special Colloquium, Department of Physics, University of California at Berkeley, October 2002.

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**CONTRIBUTED TALKS**


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1. "Ligand-Modulated Free Energy Landscapes of Glucose/Galactose Binding Protein", American Physical Society March Meeting, New Orleans, March 9-14, 2008.
2. "Shallow free energy landscapes remodeled by ligand binding", American Physical Society March Meeting, Denver, CO, March 5-9, 2007.
3. "Conformational Dynamics of the Receptor Protein Galactose/Glucose Binding Protein", American Physical Society March Meeting, Baltimore, MD, March 13-17, 2006.

4. "Tracking Amyloid Formation by Single Molecule Spectroscopy", American Chemical Society Mid-Atlantic Regional Meeting (ACS-MARM), Piscataway, NJ, May 22-25, 2005.
5. "Identifying the Mechanism for Amyloid Formation Using Single-Molecule Spectroscopy", American Physical Society March Meeting, Los Angeles, CA, March 21-25, 2005.
6. "Identifying the Mechanism for Amyloid Formation Using Single-Molecule Spectroscopy", 229<sup>th</sup> American Chemical Society National Meeting and Exposition, San Diego, CA, March 13-17, 2005.
7. "Steric Effects on the Metallic-Mirror to Transparent-Insulator Transition in Yttrium-Scandium-Hydride", American Physical Society March Meeting, Austin, TX, March 3-7, 2003.
8. "Steric Effects on the Metal-Insulator (Mirror-Transparent) Transition in  $YH_x$ ", Eighth International Symposium on Metal-Hydrogen Systems, Fundamentals and Applications (MH2002), September 2-6, 2002, Annecy, France.
9. "Optical Switching, Structure, and Transport in Y-Sc Hydride Thin Films", American Physical Society March Meeting, Indianapolis, IN, March 18-22, 2002.
10. "Magnet-on-Oscillator Characterization for Nuclear Magnetic Resonance Force Microscopy", American Physical Society March Meeting, Seattle, WA, March 12-16, 2002.

#### POSTER PRESENTATIONS

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1. "Protein free energy landscapes remodeled by ligand binding", 19th Annual Molecular Biophysics Minisymposium, Piscataway, NJ, May 4, 2007.
2. "Conformational sampling of the receptor protein glucose/galactose binding protein", 18th Annual Molecular Biophysics Minisymposium, Piscataway, NJ, May 5, 2006.
3. "Photobleaching: An Innovative Approach to Investigate Protein Self-Assembly", DIMACS Workshop on Computational/Experimental Approaches to Protein Defects in Human Disease, Piscataway, NJ, April 20-21, 2006.
4. "Optimized fluorophore counting on multiple-labeled dextran and aggregating single-labeled protein using Hidden Markov Models", 228<sup>th</sup> American Chemical Society National Meeting and Exposition, Philadelphia, PA, August 22-26, 2004.