

# Kent A. Meyer, Ph.D.

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## RESEARCH INTERESTS

Scanning probe microscopy and optical microscopy, imaging, spectroscopy, surface and homogeneous catalysis, instrumentation development, ultrafast laser physics and engineering, and computational modeling

Specific fields of current interest are *tip-controlled methods of analysis*, *ultrafast multi-dimensional spectroscopy*, *nanoscale imaging*, solar energy conversion, and projects that improve the utility of ultrafast laser equipment in harsher environments.

## EDUCATION

Ph.D., Chemistry, University of Wisconsin-Madison, Madison, WI 2004  
Dissertation: "Frequency-scanned Ultrafast Spectroscopic Techniques Applied to Infrared Four-wave Mixing Spectroscopy." GPA 3.74/4.00

B.S., Chemistry, Pennsylvania State University, University Park, PA 1998  
Minor in Physics  
GPA 3.93/4.00, with high distinction (*magna cum laude*), 145 credits accumulated

## RESEARCH EXPERIENCE

*Junior Scientist*, Fairfield Service Group, Knoxville, TN 2010

- Computational modeling for process industry instrumentation

*Postdoctoral Research Associate*, Oak Ridge Associated Universities, Oak Ridge, TN 2004-2009

Basic Energy Sciences projects:

- Ultrafast laser research
- Nanoscale desorption/ablation mass spectrometry and imaging
- Correlated non-linear optical and atomic force imaging
- Single-molecule, nanoplasmonic, and quantum dot optical probes

*Research Assistant*, University of Wisconsin-Madison, Madison, WI 1999-2004

NSF-funded projects included:

- Ultrafast multi-dimensional infrared spectroscopy as an analogue to multi-dimensional nuclear magnetic resonance

*Research Assistant*, Pennsylvania State University, University Park, PA 1996-1998

Under summer research scholarship and with semester credit:

- Synthesized and characterized novel organic charge-transfer compounds

## **TEACHING AND RELATED EXPERIENCE**

*Teaching and Laboratory Assistant -- Analytical Chemistry*, University of Wisconsin-Madison 1999  
*Teaching and Laboratory Assistant -- General Chemistry I*, University of Wisconsin-Madison 1998  
*Molecular Modeling Assistant*, Pennsylvania State University 1998  
*Chemistry Tutor*, Pennsylvania State University 1996-1998

## **OTHER EXPERIENCE**

*Consultant*, Comstock, Inc. 2010-present

- Software developer for time-of-flight mass spectrometers

## **REFEREED PUBLICATIONS**

- K.A. Meyer, A. Polemi, K.L. Shuford, W.B. Whitten, and R.W. Shaw. "Surface Coating Effects on the Assembly of Gold Nanospheres." *Nanotechnology*, **21**, 415701 (2010).
- K. Meyer, K. Ng, Z. Gu, Z.W. Pan, W.B. Whitten, and R.W. Shaw. "Combined Apertureless Near-field Optical Second Harmonic Generation/Atomic Force Microscopy Imaging and Nanoscale Limit of Detection." *Applied Spectroscopy* **64**, 1 (2010). Cover.
- J.A. Bradshaw, O. Ovchinnikova, K.A. Meyer, and D.E. Goeringer. "Combined Chemical and Topographic Imaging at Atmospheric Pressure via Microprobe Laser Desorption/Ionization Mass Spectrometry-Atomic Force Microscopy." *Rapid Communications in Mass Spectrometry*, **23**, 3781 (2009).
- K.L. Shuford, K.A. Meyer, C. Li, S.O. Cho, W.B. Whitten, and R.W. Shaw. "Computational and Experimental Evaluation of Nanoparticle Coupling." *Journal of Physical Chemistry A*, **113**, 4009 (2009).
- K.A. Meyer, O. Ovchinnikova, K. Ng, and D.E. Goeringer. "Development of a Scanning Surface Probe for Nanoscale Tip-enhanced Desorption/Ablation." *Review of Scientific Instruments*, **79**, 123710 (2008).
- Z. Zhao, K. Meyer, W. Whitten, and R. Shaw. "Optical Absorption Measurements with Parametric Down-converted Photons." *Analytical Chemistry*, **80**, 7635 (2008).
- Z. Zhao, K.A. Meyer, W.B. Whitten, R.W. Shaw, R.S. Bennink, and W.P. Grice. "Observation of Spectral Asymmetry in cw-Pumped Type-II Spontaneous Parametric Down-conversion." *Physical Review A*, **77**, 063828 (2008).
- B. Kesanli, K. Hong, K. Meyer, H-J Im, and S. Dai. "Highly Efficient Solid-state Neutron Scintillators Based on Hybrid Sol-gel Nanocomposite Materials." *Applied Physics Letters*, **89**, 214104 (2006).
- A.V. Pakoulev, M.A. Rickard, K.A. Meyer, K. Kornau, N.A. Mathew, D.E. Thompson, and J.C. Wright. "Mixed Frequency/Time-domain Optical Analogues of Heteronuclear Multi-dimensional NMR." *Journal of Physical Chemistry A*, **110**, 3352 (2006).
- K.A. Meyer, D.E. Thompson, and J.C. Wright. "Frequency and Time-resolved Triply Vibrationally Enhanced Four-wave Mixing Spectroscopy." *Journal of Physical Chemistry A*, **108**, 11485 (2004). Cover.
- D.M. Besemann, K.A. Meyer, and J.C. Wright. "Spectroscopic Characteristics of Triply Vibrationally Enhanced Four-wave Mixing Spectroscopy." *Journal of Physical Chemistry B*, **108**, 10493 (2004).
- K.A. Meyer, D.M. Besemann, and J.C. Wright. "Coherent Two-dimensional Spectroscopy with Triply Vibrationally Enhanced Infrared Four-wave Mixing." *Chemical Physics Letters*, **381**, 642 (2003).
- K.A. Meyer and J.C. Wright. "Interference, Dephasing, and Coherent Control in Time-resolved Frequency Domain Two-dimensional Vibrational Spectra." *Journal of Physical Chemistry A*, **107**, 8388 (2003).

- J.C. Wright, N.J. Condon, K.M. Murdoch, D.M. Besemann, and K.A. Meyer. "Quantitative Modeling of Non-linear Processes in Coherent Two-dimensional Vibrational Spectroscopy." *Journal of Physical Chemistry A*, **107**, 8166 (2003).
- D. Besemann, N. Condon, K. Meyer, W. Zhao, and J. Wright. "Experimental Determinations of Coherent Multi-dimensional Vibrational Spectroscopy." *Bulletin of the Korean Chemical Society*, **24**, 1119 (2003).
- K.A. Meyer and J.C. Wright. "Detection Limits for Time-resolved Coherent Two-dimensional Vibrational Spectroscopy." *Analytical Chemistry*, **73**, 5020 (2001).
- D.M. Besemann, N.J. Condon, K.M. Murdoch, K.A. Meyer, W. Zhao, and J.C. Wright. "Interference, Dephasing, and Vibrational Coupling Effects Between Coherence Pathways In Doubly Vibrationally Enhanced Nonlinear Spectroscopies." *Chemical Physics*, **266**, 177 (2001).
- K.M. Murdoch, N.J. Condon, W. Zhao, D.M. Besemann, K.A. Meyer, and J.C. Wright. "Isotope and Mode Selectivity in Two-dimensional Vibrational Four-wave Mixing Spectroscopy." *Chemical Physics Letters*, **335**, 349 (2001).
- K.M. Murdoch, D.E. Thompson, K.A. Meyer, and J.C. Wright. "Modeling Window Contributions to Four-wave Mixing Spectra and Measurements of Third Order Optical Susceptibilities." *Applied Spectroscopy*, **54**, 1495 (2000).
- W. Zhao, K.M. Murdoch, D.M. Besemann, N.J. Condon, K.A. Meyer, and J.C. Wright. "Two-dimensional Vibrational Spectroscopy by Doubly Vibrationally Enhanced Four-wave Mixing." *Applied Spectroscopy*, **54**, 1000 (2000).
- W. Zhao, K.M. Murdoch, N.J. Condon, D.M. Besemann, K.A. Meyer, P.C. Chen, J.P. Hamilton, A. Zilian, M.J. LaBuda, D.E. Thompson, R.J. Carlson, G.B. Hurst, M.T. Riebe, J.K. Steehler, and J.C. Wright. "Comparisons Between 2D Doubly Vibrationally Enhanced Four-wave Mixing and Site Selective Spectroscopy." *Journal of Luminescence*, **87-89**, 90 (2000).

#### **NON-REFEREED PUBLICATIONS**

- K.L. Shuford, K.A. Meyer, C. Li, S.-O. Cho, W.B. Whitten, and R.W. Shaw. "Nanoscale Coupling Effects on Single Particle Microscopy." *Proceedings of the SPIE*, **7033** (Plasmonics: Nanoimaging, Nanofabrication, and Their Applications IV), 70330I (2008).
- W.P. Grice, R.S. Bennink, Z. Zhao, K. Meyer, W. Whitten, and R. Shaw. "Spectral and Spatial Effects in Spontaneous Parametric Down-conversion with a Focused Pump." *Proceedings of the SPIE*, **7092** (Quantum Communications and Quantum Imaging VI), 70920Q (2008).
- J.C. Wright, W. Zhao, K.M. Murdoch, D.M. Besemann, N.J. Condon, and K.A. Meyer. "Two-dimensional Vibrational Spectroscopy by Doubly Vibrationally Enhanced Four-wave Mixing." In: *Handbook of Vibrational Spectroscopy*, vol. 1, Chambers, J.M., Griffiths, P.R., Eds. Wiley: Chichester, pp. 853-865 (2002).

#### **CONFERENCE PRESENTATIONS (with KAM as major presenter having name underlined)**

- K. Cimatu,, K.A. Meyer, S.M. Mahurin, W.B. Whitten, and R.W. Shaw. "Second Harmonic Generation Microscopy of Uncoated and Alumina-coated ZnO Nanowires and their Corrosion upon Exposure to Carbon Dioxide and Water Vapor." 14<sup>th</sup> Annual Southeast Ultrafast Conference, Oak Ridge, TN, January 2011.
- K. Cimatu,, K.A. Meyer, K.C. Ng, W.B. Whitten, and R.W. Shaw. "Carbon Dioxide and Water Corrosion of a Single ZnO Nanowire detected using Second Harmonic Generation Microscopy." American Chemical Society 240<sup>th</sup> National Meeting, Boston, MA, August 2010.
- R.W. Shaw, K.A. Meyer, K.C. Ng, and W.B. Whitten. "Nanoscale Imaging of ZnO Nanowires." Materials Research Society Spring Meeting 2010, San Francisco, CA, April 2010.

- M.M. Cable, C.S. Feigerle, K.A. Meyer, K.L. Shuford, and R.W. Shaw. "Size Correlated Single Particle Emission of Gold Spheres and Nano-octahedra." 61<sup>st</sup> Southeastern Regional Meeting of the American Chemical Society (SERMACS), San Juan, PR, October 2009.
- R.W. Shaw, K.A. Meyer, K.L. Shuford, Z.J. Gu, Z.W. Pan, and M.P. Paranthaman. "Nonlinear Optical Near-field Microscopy and Corrosion of ZnO Nanowires." American Chemical Society 238<sup>th</sup> National Meeting, Washington, DC, August 2009.
- J.A. Bradshaw, K.A. Meyer, O.S. Ovchinnikova, and D.E. Goeringer. "Investigation of Nanoscale Chemical Imaging via Tip Enhanced Near Field Desorption/Ionization Mass Spectrometry." American Society for Mass Spectrometry 57<sup>th</sup> Annual Conference, Philadelphia, PA, June 2009.
- D.E. Goeringer, J.A. Bradshaw, K.A. Meyer, and O.S. Ovchinnikova. "Developments in Instrumentation for Atmospheric Pressure Nanoscale Chemical Imaging via Tip-enhanced Near-field Desorption/Ionization Mass Spectrometry." American Society for Mass Spectrometry 57<sup>th</sup> Annual Conference, Philadelphia, PA, June 2009.
- M.M. Cable, C.S. Feigerle, K.A. Meyer, K.L. Shuford, and R.W. Shaw. "Size Correlated Single Particle Emission of Gold Nano-octahedra." 60<sup>th</sup> Southeastern Regional Meeting of the American Chemical Society (SERMACS), Nashville, TN, November 2008.
- R.W. Shaw, W.B. Whitten, K.A. Meyer, K.L. Shuford, K. Ng, and S.-O. Cho. "Laser Spectroscopy/Imaging at the Nanoscale." American Chemical Society 236<sup>th</sup> National Meeting, Philadelphia, PA, August 2008.
- K. Meyer, D. Goeringer, O. Ovchinnikova, and K. Ng. "Toward Nanoscale Chemical Imaging: Investigation of Tip-enhanced Near-field Optical Methods for Desorption/Ionization Mass Spectrometry at Atmospheric Pressure." American Society for Mass Spectrometry 56<sup>th</sup> Annual Conference, Denver, CO, June 2008.
- K. Meyer, W. Whitten, R. Shaw, K. Ng, and T. Zeng. "Single Photon Emission from Indium Phosphide Nanoparticles." American Chemical Society 235<sup>th</sup> National Meeting, New Orleans, LA, April 2008.
- K.A. Meyer, K.L. Shuford, W.B. Whitten, and R.W. Shaw. "Nanoscale Raman Imaging Using a Dual Atomic Force/Near-field Scanning Optical Microscope." American Chemical Society 235<sup>th</sup> National Meeting, New Orleans, LA, April 2008.
- K.L. Shuford, Y.-N. Kim, C. Li, S.-O. Cho, M.M. Cable, C.S. Feigerle, K.A. Meyer, W.B. Whitten, and R.W. Shaw. "Single Particle Microscopy and Extinction Spectra of Gold Nano-octahedra." Materials Research Society Spring Meeting 2008, San Francisco, CA, March 2008.
- W.B. Whitten, Z. Zhao, K.A. Meyer, and R.W. Shaw. "Analytical Entanglements." American Chemical Society 234<sup>th</sup> National Meeting, Boston, MA, August 2007.
- Z. Zhao, K.A. Meyer, W.B. Whitten, and R.W. Shaw. "Polarization-sensitive Quantum-optical Coherence Tomography with Entangled Photons." International Conference on Quantum Information (ICQI), Rochester, NY, June 2007.
- K.A. Meyer, S.W. Allison, R.W. Shaw, C.S. Feigerle, M.M. Cable, and P.R. Boudreaux. "Colliding Two-photon Emission Spectroscopy in Rare-earth Doped Fibers and Sol-gels." 10<sup>th</sup> Annual Southeast Ultrafast Conference, Nashville, TN, January 2007.
- K.A. Meyer. "Up-conversion Methods for Multi-dimensional Infrared Spectroscopy." Division of Atomic, Molecular, and Optical Physics 37<sup>th</sup> Annual Meeting, Knoxville, TN, June 2006.
- J.C. Wright and K.A. Meyer. "Frequency and Time Resolved Coherent Multi-dimensional Vibrational Spectroscopy." American Chemical Society 229<sup>th</sup> National Meeting, San Diego, CA, March 2005.
- J. Wright, A. Pakoulov, M. Rickard, N. Mathew, K. Kornau, K. Meyer, and D. Thompson. "Mixed Frequency/Time-domain Coherent Multi-dimensional Spectroscopy – The Optical Analogue to Multi-dimensional Heteronuclear NMR Methods." International Conference on 2D Correlation Spectroscopy, Delavan, WI, August 2005.

K.A. Meyer, J.C. Wright, and D.E. Thompson. "Frequency and Time-resolved Coherent Multi-dimensional Vibrational Spectroscopy." International Conference on Coherent Multi-dimensional Spectroscopy, Madison, WI, August 2004.

K.A. Meyer, D.E. Thompson, and J.C. Wright. "Spectrally Resolved Vibrational Coupling of Two Different Modes of a Small Molecule Through Triply Vibrationally Enhanced Four-wave Mixing." American Chemical Society 227<sup>th</sup> National Meeting, Anaheim, CA, April 2004.

K.A. Meyer and J.C. Wright. "Background and Coherent Anti-Stokes Raman Scattering Suppression in Doubly Vibrationally Enhanced Four-wave Mixing Spectra Using Ultrafast Lasers." Federation of Analytical Chemistry and Spectroscopy Societies 2001 meeting, Detroit, MI, October 2001.

J. Wright, W. Zhao, K. Murdoch, D. Besemann, N. Condon, and K. Meyer. "Introduction to Coherent 2D Vibrational Spectroscopy." Federation of Analytical Chemistry and Spectroscopy Societies 2001 (28<sup>th</sup>) meeting, Detroit, MI, October 2001.

K.A. Meyer and J.C. Wright. "Frequency Domain Multi-dimensional Ultrafast Spectroscopy with Doubly Vibrationally Resonant Non-linear Processes." American Physical Society March Meeting 2000, Minneapolis, MN, March 2000.

K.M. Murdoch, N.J. Condon, D.M. Besemann, K.A. Meyer, and J.C. Wright. "Doubly Resonant Frequency Domain Vibrational Spectroscopy." American Physical Society March Meeting 2000, Minneapolis, MN, March 2000.

W. Zhao, K.M. Murdoch, N.J. Condon, D.M. Besemann, K.A. Meyer, P.C. Chen, J.P. Hamilton, A. Zilian, M.J. LaBuda, D.E. Thompson, R.J. Carlson, G.B. Hurst, M.T. Riebe, J.K. Steehler, and J.C. Wright. "Comparisons Between 2D Doubly Vibrationally Enhanced Four-wave Mixing and Site Selective Spectroscopy." International Conference on Luminescence and Optical Spectroscopy of Condensed Matter, Osaka, Japan, August 1999.

## **SKILLS**

A cross-disciplinary background was developed including organic molecule synthesis, purification/analysis (chromatography/NMR), and basic inorganic chemistry synthetic (thin film, sol gel, zone furnace) and analytical (surface profiling, scanning electron microscopy) methods. Ultrahigh vacuum skill was improved on through the outstanding expertise at Oak Ridge National Laboratory. Experience was acquired with mass spectrometers (MALDI-TOF, ion trap) and mass spectrometry interfacing methods (LDI, electrospray). Professional expertise in classical optics, microscopy, and imaging/imaging analysis was acquired. Nanoscience skills were developed in atomic force microscopy (AFM) and near-field scanning optical microscopy (NSOM). Work in instrumentational development has resulted in intermediate-level knowledge of electronics and working knowledge of microwave RF design, metal machining, fiber optics, and basic construction and maintenance.

A unique practical skill developed was mechanical/acoustic noise dampening. Laboratory environmental noise (from pumps, fans, hoods, user motion, and noise coupled externally) was reduced to the level whereby nanoscientific equipment would yield satisfactory data.

The computer languages LabVIEW and Matlab were extensively studied. Mid-level computer languages (Fortran, C, HTML) were studied. Programming and scripting was geared for the development of graphical user interfaces (GUIs). Experience with several forms of spreadsheets and data analysis packages (Igor Pro, Origin, Excel). A working knowledge of Unix/Linux (including shell scripting) was acquired as a result of ancillary projects.

Work with laser spectroscopy and imaging has necessitated an expert-level knowledge in the architecture, assembly, maintenance, modification, and troubleshooting of many table-based laser equipment as well as the necessary understanding of laser optics, optical design, and optical detectors for their work. A large part of recent pulsed laser experiments relate to locking with other lasers or equipment.

List of laser experience:

- Titanium: sapphire
- Argon-ion
- Neodymium: yttrium aluminum garnet
- Excimer
- Helium-neon
- Helium-cadmium
- Dye
- Diode
- Ultrafast oscillators
- Ultrafast regenerative amplifiers
- Optical parametric amplifiers (including tunable infrared and ultraviolet)
- Optical parametric oscillators
- Autocorrelators and related time-resolving equipment (frequency-resolved optical gating)

### **AWARDS**

McElvain Award, University of Wisconsin-Madison (1998)

Roger J. Carlson Memorial Award, University of Wisconsin-Madison (2004)

Society for Applied Spectroscopy Meggers Award (2011)

### **PROFESSIONAL MEMBERSHIPS**

American Chemical Society

Society for Applied Spectroscopy

Phi Beta Kappa, Pennsylvania State University