

Kent A. Meyer, Ph.D.

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RESEARCH INTERESTS

My specific fields of interest are *nanoscale tip-controlled methods of analysis, ultrafast laser optics and spectroscopy, imaging, surface analysis*, nonlinear optics, and single-molecule studies. I am also interested in analytical instrumentation development projects and in research involving physical chemistry.

EDUCATION

Ph.D., Chemistry (physical), University of Wisconsin-Madison, Madison, WI 1998-2004
Dissertation: "Frequency-scanned Ultrafast Spectroscopic Techniques Applied to Infrared Four-wave Mixing Spectroscopy." GPA 3.74/4.00
Research Adviser: John C. Wright, Department of Chemistry

B.S., Chemistry, Pennsylvania State University, University Park, PA 1994-1998
Minor in Physics
GPA 3.93/4.00, with high distinction (*magna cum laude*), 145 credits accumulated

WORK EXPERIENCE

Consultant, Comstock, Incorporated, Oak Ridge, TN 2010-2016

- Project developer and consultant on novel time-of-flight mass spectrometers and interfaces
 - Chemometrics for improving performance of spectrometer
 - Computer simulations and mechanical/electrical design
 - Coordinated with engineers and consultants to troubleshoot design problems
 - Performed laser ionization studies for system analysis
- Software developer of graphical user and computer/embedded system interfaces of novel instrumentation
 - API development for customers at professional level

Junior Scientist, Fairfield Service Group, Knoxville, TN 2010

- Computational modeling and documentation of process industry instrumentation

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

Department of Energy Basic Energy Sciences projects at Oak Ridge National Laboratory included:

- Ultrafast laser research
 - Laser/scanning probe synchronization studies
 - Two-photon thermometry
 - Microscopy and imaging of nanoscale materials using novel interface methods
 - Time-resolved fluorescence
 - Fiber optic delivery methods
- Nanoscale desorption/ablation mass spectrometry and imaging utilizing scanning probe methods
- Correlated non-linear optical (apertureless near-field) and atomic force microscopy imaging
 - Raman near-field scanning optical microscopy (NSOM) of suspended thin films

- Tip enhanced non-linear optical imaging of semiconductor nanowires and chemical reactions under controlled environments
- Surface second harmonic generation and mid-infrared sum frequency generation of mineral surfaces
- Non-linear optical coupling theory and data fitting
- Photon-pair entanglement
- Single-molecule, nanoplasmonic, and quantum dot optical probe studies
 - Imaging of semiconductor nanoparticles
 - Photon antibunching of single nanoparticles/ molecules
 - Mechanical manipulation, computer simulation, and near field imaging of nanoplasmonic particles
- Software development and computational modeling for imaging and analysis
- System maintenance and upgrading

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

National Science Foundation-funded project included:

- Ultrafast multi-dimensional infrared spectroscopy as an analogue to multi-dimensional nuclear magnetic resonance (NMR)
 - Project development included system optical, electronic design, and user interfacing
 - Homogeneous catalyst and small molecule studies for theoretical fits and projections
 - Derived and employed hybrid time and frequency domain transitional mathematical models
 - Continuous system maintenance and upgrading
- Related FT-IR, conventional Raman, optical pump-probe, and stimulated coherent spectroscopy (CARS) studies
- Rigorous data fitting and analysis of complex ultrafast non-linear optical spectra via modeling software

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

Undergraduate summer research scholarship and with semester credit:

- Synthesized novel organic twisted internal charge-transfer (TICT) compounds with homolytic/heterolytic cleavage mechanisms, characterized using electrochemistry, NMR, and time-resolved fluorescence

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

REFEREED PUBLICATIONS

- [1]. K.A. Cimat, S.M. Mahurin, K.A. Meyer, and R.W. Shaw. "Nanoscale Chemical Imaging of Zinc Oxide Nanowire Corrosion." *Journal of Physical Chemistry C*, **116**, 10405 (2012).
- [2]. 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).
- [3]. 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. SAS William F. Meggers Award.
- [4]. 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).

- [5]. 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).
- [6]. 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).
- [7]. Z. Zhao, K. Meyer, W. Whitten, and R. Shaw. "Optical Absorption Measurements with Parametric Down-converted Photons." *Analytical Chemistry*, **80**, 7635 (2008).
- [8]. 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).
- [9]. 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).
- [10]. 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).
- [11]. 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.
- [12]. 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).
- [13]. 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).
- [14]. 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).
- [15]. 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).
- [16]. 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).
- [17]. K.A. Meyer and J.C. Wright. "Detection Limits for Time-resolved Coherent Two-dimensional Vibrational Spectroscopy." *Analytical Chemistry*, **73**, 5020 (2001).
- [18]. 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).
- [19]. 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).
- [20]. 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).
- [21]. 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).

- [22]. 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

- [1]. 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).
- [2]. 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).
- [3]. 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)

- R.W. Shaw, K.A. Meyer, K. Ng, Z. Gu, Z. Pan, W.B. Whitten, and K. Cimatu. "Nanoscale Chemical Imaging via Nonlinear Optical Microscopy." Federation of Analytical Chemistry and Spectroscopy Societies 2011 (38th) meeting, Reno, NV, October 2011. Plenary.
- K.A. Cimatu, K.A. Meyer, S.M. Mahurin, W.B. Whitten, and R.W. Shaw. "Sub-diffraction-limited Second Harmonic Generation Microscopy of Uncoated and Alumina-coated ZnO Nanowires." American Chemical Society 242nd National Meeting, Denver, CO, August 2011.
- T.Y. Zeng, C. Norris, K.A. Meyer, W.B. Whitten, R.W. Shaw, and K. Ng. "Photoluminescence of Indium Phosphide Dots." American Chemical Society 241st National Meeting, Anaheim, CA, March 2011.
- 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." 14th 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 240th 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." 61st 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 238th 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 57th 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 57th 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." 60th 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 236th 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 56th 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 235th 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 235th 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 234th 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." 10th 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 37th 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 229th 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 227th 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 (28th) 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. Stehler, 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

Skilled in scanning probe microscopes, spectroscopy and non-linear optical spectroscopy, optical microscopy, user interfacing and programming, imaging, prototyping, computational modeling and data analysis, documentation writing, presentations.

Specialized in correlating AFM with optical data. Specialized in non-linear optical data fitting, particularly involving resonances, including frequency, time, and mixed-domain models.

Experienced in mass spectrometry, high vacuum equipment work, ultrafast laser science, non-linear optics, nanoplasmonics, detectors (photons and ions), and electronics. Experienced with other analytical chemistry methods ((fast) GC-MS and wet chemistry techniques, FT-IR, Raman), as well as with organic, nanoparticle, and thin film synthesis, SEM, fiber optics, metal machining, and CAD.

Familiarity with NMR, molecular modeling, and electrochemistry.

Computer programming languages and projects utilizing these languages:

- C, C#/.NET – driver API/library development
- FORTRAN – computational modeling projects, classwork
- LabVIEW – prototyping and professional GUI
- HTML/CSS (cursory) – former group webmaster
- Unix, Linux, Unix/Linux shell scripting – research, classwork

Computer programs:

- Microsoft Excel, Word, PowerPoint, Visual Studio
- MathCAD, Mathematica, Origin, Igor Pro
- Matlab + GUIDE, Scilab
- Adobe Photoshop and similar programs

Spoken languages:

- English (native)
- German (novice, through coursework)

Laser experience, including basic maintenance:

- Titanium: sapphire
- Argon-ion
- Neodymium: YAG/YLF
- Excimer
- Helium-neon
- Ultrafast oscillators (fs)
- Ultrafast regenerative amplifiers (psec & fs)
- Optical parametric amplifiers (including tunable infrared and ultraviolet)
- Optical parametric oscillators (ns)

- Helium-cadmium
- Dye + amplifiers
- Diode
- Laser safety course credit (LIA)
- Autocorrelators and related time-resolving equipment (e.g., frequency-resolved optical gating)

OTHER INTERESTS

I am greatly interested in learning computer programming languages and am interested in learning additional spoken languages.

AWARDS

McElvain Award, University of Wisconsin-Madison (1998)

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

Society for Applied Spectroscopy William F. Meggers Award (2011)

PROFESSIONAL MEMBERSHIPS

American Chemical Society

Society for Applied Spectroscopy

Phi Beta Kappa, Pennsylvania State University