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## **Markus B. Raschke**

### **EDUCATION AND PROFESSIONAL EXPERIENCE**

#### **University of Colorado**

Department of Physics, Professor, since 2/2015, Associate Professor 2010-2014  
Department of Chemistry, Affiliate Professor  
JILA, Fellow Adjunct.

Research: Linear, nonlinear, and ultrafast near-field optics for imaging and spectroscopy with nanometer spatial and femtosecond temporal resolution: study and control of light-matter interaction on the nanoscale, engineering plasmonic structures for optical nanofocusing, IR optical antennas for enhanced vibrational nano-spectroscopy, investigating electron and vibrational dynamics of molecular nano-composites, polymers, and phase behavior and domain formation of quantum materials.

#### **University of Washington**

Associate Professor of Chemistry 9/2009 – 8/2010, Adjunct Associate Professor of Physics 9/2007 – 8/2010, Assistant Professor of Chemistry 9/2006 – 8/2009

#### **Max-Born-Institute, Berlin, Germany**

Staff Scientist, Group Leader 1/2004 – 7/2006.

Postdoctoral Associate (Host: Prof. T. Elsaesser) 2002-2003.

Demonstrated all optical ultrahigh spatial resolution of sub-10 nm in the infrared, single molecule sensitivity in tip-enhanced Raman spectroscopy, and nonlinear optical probing of symmetry properties on the nanoscale.

#### **Humboldt University, and Free University, Berlin, Germany**

Instructor, Departments of Physics 2003 – 2006.

Teaching undergraduate Advanced Optics Labs and Condensed Matter Physics.

#### **University of California at Berkeley**

Postdoctoral Research Associate (Host: Prof. Y. R. Shen) 1999-2001.

Developed doubly-resonant sum-frequency generation (DR-SFG) and transient second-harmonic hole burning as nonlinear surface spectroscopies to study adsorbate vibronic coupling and electron dynamics at surfaces and interfaces.

**Max-Planck-Institute for Quantum Optics, Garching, Germany**  
**Technische Universität, Munich, Germany**

Graduate Student, Ph.D. Physics (Advisors: U. Höfer & D. Menzel) 1995-1999.

Established the relationship of surface electronic and lattice structure to adsorption and surface diffusion on silicon applying linear and nonlinear optical probe techniques. Thesis: *Optical second-harmonic investigations of the kinetics of elementary surface reactions on Si(001) and Si(111)*.

**Rutgers University**

Fulbright Fellowship, M.S. Physics (Advisor: Prof. T. Madey) 1994 -1995

Electron stimulated desorption ion angular distribution (ESDIAD). Thesis: *Transmission of low energy ( $\leq 10$  eV) protons and deuterons through ultrathin rare gas films*.

**Universität Bayreuth, Germany**

B.S.s (Vordiplom), Physics and Chemistry

**HONORS/AWARDS**

- 2017 Friedrich Wilhelm Bessel Award, Humboldt Foundation
- 2017 Fellow, American Association for the Advancement of Science (AAAS)
- 2016 Visiting Professor, Fritz-Haber-Institute, Max-Planck-Society, Berlin
- 2015 Klaus Halbach Award, Lawrence Berkeley National Laboratory
- 2013 Fellow of the American Physical Society
- 2013 Visiting Professor, ETH Zürich, 6-7/2013
- 2012 Fellow of the Optical Society of America
- 2012 Wiley Research Fellow, Pacific Northwest National Laboratory
- 2012 Visiting Professor, Abbe School of Photonics, Jena, 6-8/2012
- 2008 National Science Foundation CAREER Award
- 1999 Alexander von Humboldt Foundation, Feodor Lynen Fellowship
- 1999 Otto-Hahn-Medal of the Max-Planck-Society, Award
- 1994 Fulbright Award and Fellowship, to study at Rutgers University
- 1992 Friedrich Naumann Foundation, Fellowship, Universität Bayreuth

**EDITOR**

Editorial Board: Progress in Surface Science  
Guest Editor: Synchrotron Radiation News  
Associate Editor: Science Advances

**EXTERNAL RESEARCH CONTRACTS/ACTIVITIES**

**Environmental Molecular Sciences Laboratory (EMSL), at Pacific Northwest National Laboratory (PNNL):** Partner proposal, Broadband mid-IR spectroscopic nano-imaging for molecular and correlated nano-materials research.

**Advanced Light Source (ALS) at Lawrence Berkeley National Laboratory (LBL):**

Development of scattering scanning near-field microscopy at the IR beamline.

**Anasys Instruments Inc. (Santa Barbara):**

Scientific advisory board, inventor of thermal near-field infrared spectroscopy.

**Bruker Nano (Santa Barbara):**

Partnership and consulting, development of optical scanning probe microscopy.

**PATENTS**

*“High Frequency Deflection Measurement of IR Absorption”*, Inventors: M. Belkin, F. Lu, V. Yakovlev, C. Prater, K. Kjoller, and M. B. Raschke, patent number US 8,869,602.

*“Infrared Imaging Using Thermal Radiation from a Scanning Probe Tip”*, Inventor: M. B. Raschke, patent number US 7,977,636.

*“Method and Apparatus for Physical Property Measurement using Probe-based Nano-localized Light Source”*, M. B. Raschke, S. Minne, C. Su, S. Kammer, patent number US 20,160,033,547.

*“Method and Apparatus for Infrared Scattering Scanning Near-Field Optical Microscopy”*, C. Prater, M. B. Raschke, and S. Berweger, patent number US 8,793,811.

**INVITED BOOK CHAPTERS AND REVIEWS**

94. Ch. Lienau, M. B. Raschke, and C. Ropers “Ultrafast nano-focusing for imaging and spectroscopy with electrons and light”, in *Nanophysics*, eds. P. Hommelhoff and M. F. Kling, Wiley-VCH, Weinheim (2015).
93. M. B. Raschke, S. Berweger, and J. M. Atkin “Ultrafast and nonlinear plasmon dynamics”, in *Plasmonics: Theory and Applications*, eds. T. V. Shahbazyan and M. I. Stockman, Springer, Berlin (2013).
92. A. C. Jones, H. U. Yang, B. T. O’Callahan, and M. B. Raschke, “Thermal near-field: coherence, spectroscopy, heat-transfer, and optical forces” *Prog. Surf. Sci.* **88**, 349 (2013).
91. J. M. Atkin, S. Berweger, A. C. Jones, and M. B. Raschke, “Nano-optical imaging and spectroscopy of order, phases, and domains in complex solids.” *Advances in Physics* **61**, 745 (2012).
90. R. L. Olmon and M. B. Raschke, “Antenna-load interactions at optical frequencies: impedance matching to quantum systems” *Nanotechnology* **23**, 444001 (2012).

**PERSPECTIVES AND OPINIONS**

89. J. M. Aktin and M. B. Raschke, “Optical spectroscopy goes intramolecular” *Nature* **498**, 44 (2013).
88. M. B. Raschke, “High-harmonic generation with plasmonics: feasible or unphysical” *Ann. Phys.* **525**, A40 (2013).

**SELECTED PUBLICATIONS (most significant original work, of 100+)**

87. K.-D. Park, M. B. Raschke, J. M. Atkin, Y. H. Lee, and M. S. Jeong, "Probing bilayer grain boundaries in large area graphene with tip-enhanced Raman spectroscopy", *Advanced Materials*, ASAP (2016).
86. B. T. O'Callahan and M. B. Raschke, "Laser heating of scanning probe tips for thermal near-field spectroscopy and imaging", *APL Photonics*, **2**, 021301 (2016).
85. E. Muller, B. Pollard, H. A. Bechtel, P. van Blerkom, and M. B. Raschke, "Infrared vibrational nano-crystallography and -imaging", *Science Advances*, **2**, e1601006 (2016).
84. B. Metzger, B. Pollard, I. Rimke, E. Buettner, and M. B. Raschke, "Single-step sub-200 fs mid-infrared generation from an optical parametric oscillator synchronously pumped by an erbium fiber laser", *Opt. Lett.*, **41**, 4383 (2016).
83. K.-D. Park, M. B. Raschke, M. J. Jang, J. H. Kim, B.-H. O, S.-G. Park, E.-H. Lee, and S. G. Lee, "Near-field imaging of cell membranes in liquid enabled by active scanning probe mechanical resonance control", *J. Phys. Chem. C*, **120**, 21138 (2016).
82. H. U. Yang and M. B. Raschke, "Resonant optical gradient force interaction for nano-imaging and -spectroscopy", *New J. Phys.*, **18**, 053042 (2016).
81. B. Pollard and M. B. Raschke, "Correlative infrared nanospectroscopy and nanomechanical imaging of block copolymer microdomains", *Beilstein J. Nanotechnol.*, **7**, 605 (2016).
80. S. Doenges, O. Khatib, B. T. O'Callahan, J. M. Atkin, J. H. Park, D. Cobden, and M. B. Raschke, "Ultrafast nanoimaging of the photoinduced phase transition dynamics of VO<sub>2</sub>", *Nano Letters*, **16**, 3029 (2016).
79. Y. Xu, E. Tucker, G. Boreman, M. B. Raschke, and B. A. Lail, "Optical nanoantenna input impedance", *ACS Photonics*, **3**, 881 (2016).
78. M. Müller, V. Kravtsov, A. Paarmann, M. B. Raschke, and R. Ernstorfer, "Nanofocused plasmon-driven sub-10 fs electron point source", *ACS Photonics*, **3**, 611 (2016).
77. V. Kravtsov, R. Ulbricht, J. M. Atkin, and M. B. Raschke, "Plasmonic nanofocused four-wave mixing for femtosecond near-field imaging" *Nature Nanotechnol.* **11**, 459 (2016).
76. K.-D. Park, O. Khatib, V. Kravtsov, G. Clark, X. Xu, and M. B. Raschke, "Hybrid tip-enhanced nanospectroscopy and nanoimaging of monolayer WSe<sub>2</sub> with local strain control" *Nano Letters* **16**, 2621 (2016).
75. K.-D. Park, E. A. Muller, V. Kravtsov, P. M. Sass, J. Dreyer, J. M. Atkin, and M. B. Raschke, "Variable-temperature tip-enhanced Raman spectroscopy of single-molecule fluctuations and dynamics" *Nano Letters* **16**, 479 (2016).
74. B. Pollard, F. C. B. Maia, M. B. Raschke, and R. O. Freitas "Infrared vibrational nanospectroscopy by self-referenced interferometry" *Nano Letters* **16**, 55 (2016).
73. B. T. O'Callahan, W. E. Lewis, S. Möbius, J. C. Stanley, E. A. Muller, and M.B. Raschke, "Broadband infrared vibrational nano-spectroscopy using thermal blackbody radiation" *Optics Express* **23**, 32063 (2015).
72. J. M. Atkin, P. M. Sass, P. E. Teichen, J. D. Eaves, and M.B. Raschke, "Nanoscale probing of dynamics in local molecular environments" *J. Phys. Chem. Lett.* **100**, 2123 (2015).
71. J. Allaz, M. B. Raschke, P. M. Persson, and C. R. Stern, "Age, petrochemistry, and origin of a REE-rich mineralization in the Longs Peak-St. Vrain Batholith, near Jamestown, Colorado (U.S.A.)" *Am. Min.* **6**, 4616 (2015).
70. M. B. Raschke, E. J. D. Anderson, J. Allaz, H. Friis, J. R. Smyth, R. Tschernich, and R.

- Becker, "Crystal chemistry of brannockite,  $\text{KLi}_3\text{Sn}_2\text{Si}_{12}\text{O}_{30}$ , from a new occurrence in the Golden Horn Batholith, Washington State, USA" *Am. Min.* **27**, 5 (2015).
69. H. U. Yang, J. D'Archangel, M. L. Sundheimer, E. Tucker, G. D. Boreman, and M. B. Raschke "Optical dielectric function of silver" *Phys. Rev. B* **91**, 235137 (2015) (Editor's Suggestion).
  68. M. Liu, A. J. Sternbach, M. Wagner, T. V. Slusar, T. Kong, S. L. Bud'ko, S. Kittiwatanakul, M. M. Qazilbash, A. McLeod, Z. Fei, E. Abreu, J. Zhang, M. Goldflam, S. Dai, G.-X. Ni, J. Lu, H. A. Bechtel, M. C. Martin, M. B. Raschke, R. D. Averitt, S. A. Wolf, H.-T. Kim, P. C. Canfield, and D. N. Basov "Phase transition in bulk single crystals and thin films  $\text{VO}_2$  by nanoscale infrared spectroscopy and imaging" *Phys. Rev. B* **91**, 245155 (2015) (Editor's Suggestion)
  67. Z. Shi, H. A. Bechtel, S. Berweger, Y. Sun, B. Zeng, C. Jin, H. Chang, M. C. Martin, M. B. Raschke, and F. Wang, "Amplitude- and phase-resolved nano-spectral imaging of phonon polaritons in hexagonal boron nitride" *ACS Photonics*, **2**, 790 (2015).
  66. B. T. O'Callahan, J. M. Atkin, A. C. Jones, J. H. Park, D. Cobden, and M. B. Raschke, "Inhomogeneity in the ultrafast insulator-to-metal transition dynamics of  $\text{VO}_2$ " *Nature Commun.* **6**, 6849 (2015).
  65. E. A. Muller, B. Pollard, and M. B. Raschke, "Infrared chemical nano-imaging: accessing structure, coupling, and dynamics on molecular length scales" *J. Phys. Chem. Lett.* **6**, 1275 (2015).
  64. M. S. Dodderi, J. M. Atkin, P. K. B. Palomaki, N. R. Neale, J. L. Blackburn, J. C. Johnson, A. J. Nozik, M. B. Raschke, and M. C. Beard, "Quantum confined electron-phonon interaction in silicon nanocrystals" *Nano Lett.*, **15**, 1511 (2015).
  63. H. U. Yang, R. L. Olmon, K. S. Deryckx, X. G. Xu, H. A. Bechtel, Y. Xu, B. A. Lail, and M. B. Raschke, "Accessing the optical magnetic near-field through Babinet's principle" *ACS Photonics* **1**, 894 (2014).
  62. V. Kravtsov, S. Berweger, J. M. Atkin, and M. B. Raschke, "Control of plasmon emission and dynamics at the transition from classical to quantum coupling" *Nano Lett.* **14**, 5270 (2014).
  61. J. A. Gerber, S. Berweger, B. T. O'Callahan, and M. B. Raschke, "Phase resolved surface plasmon interferometry of graphene" *Phys. Rev. Lett.* **113**, 055502 (2014).
  60. B. T. O'Callahan, W. E. Lewis, A. C. Jones, and M. B. Raschke, "Spectral frustration and spatial coherence in thermal near-field spectroscopy" *Phys. Rev. B* **89**, 245446 (2014).
  59. H. A. Bechtel, E. A. Muller, R. L. Olmon, M. C. Martin and M. B. Raschke, "Ultra-broadband infrared nanospectroscopic imaging" *PNAS* **111**, 7191 (2014).
  58. B. Pollard, E. A. Muller, K. Hinrichs, and M. B. Raschke, "Vibrational nano-spectroscopic imaging correlating structure with intermolecular coupling and dynamics" *Nature Commun.* **5**, 3587 (2014).
  57. C. Blum, et al., "Tip-enhanced Raman spectroscopy – a interlaboratory reproducibility and comparison study" *J. Raman Spectrosc.* **45**, 22 (2014).
  56. S. Berweger, D. M. Nguyen, E. A. Muller, H. A. Bechtel, T. T. Perkins, and M. B. Raschke, "Nano-chemical infrared imaging of membrane proteins in native lipid bilayers" *JACS* **135**, 18292 (2013).
  55. I. M. Craig, M. Taubman, A. S. Lea, M. C. Phillips, E. E. Josberger, and M. B. Raschke, "Infrared near-field spectroscopy of trace explosives using an external cavity quantum cascade laser" *Optics Express* **21**, 30401 (2013).

54. E. Tucker, J. D'Archangel, M. B. Raschke, E. Briones, F. J. Gonzales, and G. Boreman "Near-field mapping of dipole nano-antenna-coupled bolometers" *J. Appl. Phys.* **114**, 033109 (2013).
53. J. D'Archangel, E. Tucker, E. Kinzel, E. A. Muller, H. A. Bechtel, M. C. Martin, M. B. Raschke, and G. Boreman "Near- and far-field spectroscopic imaging investigation of resonant square-loop infrared metasurfaces" *Optics Express Phys.* **21**, 17150 (2013).
52. V. Kravtsov, J. M. Atkin, and M. B. Raschke, "Group delay and dispersion in adiabatic plasmonic nanofocusing" *Opt. Lett.* **38**, 1322 (2013).
51. X. G. Xu and M. B. Raschke, "Near-field infrared vibrational dynamics and tip-enhanced decoherence" *Nano Letters* **13**, 1588 (2013).
50. H. U. Yang, E. Hebestreit, E. E. Josberger, and M. B. Raschke, "A cryogenic scattering-type scanning near-field optical microscope", *Rev. Sci. Instrum.* **84**, 023701 (2013).
49. R. L. Olmon, B. Slovick, T. W. Johnson, D. Shelton, S.-H. Oh, G. D. Boreman, and M. B. Raschke, "Optical dielectric function of gold", *Phys. Rev. B.* **86**, 235147 (2012).
48. X. G. Xu, M. Rang, I. M. Craig, and M. B. Raschke, "Pushing the sample-size limit of infrared vibrational nano-spectroscopy: from monolayer towards single molecule sensitivity", *J. Phys. Chem. Lett.* **3**, 1836 (2012).
47. S. Berweger, J. M. Atkin, and M. B. Raschke, "Light on the tip of a needle: Plasmonic nanofocusing for spectroscopy on the nanoscale" *J. Phys. Chem. Lett.* **3**, 945 (2012).
46. A. C. Jones and M. B. Raschke, "Thermal near-field infrared spectroscopy" *Nano Letters* **12**, 1475 (2012).
45. J. M. Atkin, S. Berweger, E. Chavez, M. B. Raschke, J. Cao, W. Fan, and J. Wu "Strain and temperature dependence of the insulating phases of VO<sub>2</sub> near the metal-insulator transition" *Phys. Rev. B. (Rapid Communication)* **85**, 020101(R), (2012).
44. S. Berweger, J. M. Atkin, X. G. Xu, R. L. Olmon, and M. B. Raschke, "Femtosecond nanofocusing with full optical waveform control", *Nano Lett.* **11**, 4309 (2011).
43. S. Berweger, J. M. Atkin, R. L. Olmon, and M. B. Raschke, "Adiabatic tip-plasmon focusing for nano-Raman spectroscopy", *J. Phys. Chem. Lett.* **1**, 3427 (2010).
42. R. L. Olmon, P. M. Krenz, B. A. Lail, L. V. Saraf, G. D. Boreman, and M. B. Raschke, "Determination of electric-field, magnetic-field, and electric-current distributions of infrared optical antennas: A near-field optical vector network analyzer" *Phys. Rev. Lett.* **105**, 167403 (2010).
41. P. M. Krenz, R. L. Olmon, B. A. Lail, M. B. Raschke, and G. D. Boreman, "Near-field measurement of infrared coplanar strip transmission line attenuation and propagation constants", *Optics Express* **18**, 21678 (2010).
40. A. Anderson, K. S. Deryckx, X. G. Wu, G. Steinmeyer, and M. B. Raschke, "Few-femtosecond plasmon dephasing of a single metallic nanostructure from optical response function reconstruction by interferometric frequency resolved optical gating" *Nano Letters.*, **10**, 2519 (2010).
39. A. C. Santulli, H. Zhou, S. Berweger, M. B. Raschke, E. Sutter, and S. S. Wong "Synthesis of single-crystalline one-dimensional LiNbO<sub>3</sub> nanowires", *CrystEngComm*, **12**, 2675 (2010).
38. A. C. Jones, S. Berweger, J. Wei, D. Cobden, and M. B. Raschke, "Nano-optical investigations of the phase behavior of the metal-insulator transition of individual VO<sub>2</sub> microcrystals", *Nano Letters*, **10**, 1574 (2010).

37. C. C. Neacsu, S. Berweger, R. L. Olmon, L. V. Saraf, C. Ropers, and M. B. Raschke, "Near-field localization in plasmonic superfocusing: a nanoemitter on a tip", *Nano Letters* **10**, 592 (2010).
36. S. Berweger, M. B. Raschke, "Signal limitations in tip-enhanced Raman scattering: the challenge to become a routine analytical technique", *Anal. Bioanal. Chem.* **396**, 115 (2009).
35. S. Berweger, M. B. Raschke, "Polar phonon mode selection rules in tip-enhanced Raman scattering for optical nano-crystallography", *J. Raman Spectroscopy* **40**, 1413 (2009).
34. A. C. Jones, R. L. Olmon, S. Skrabalak, B. J. Wiley, Y. Xia, and M. B. Raschke, "Mid-IR plasmonics: Near-field imaging of coherent plasmon modes of silver nanowires", *Nano Lett.* **9**, 2553 (2009).
33. S. Berweger, C. C. Neacsu, A. Mao, H. Zhou, S. S. Wong, M. B. Raschke, "Optical nanocrystallography with tip-enhanced phonon Raman spectroscopy", *Nature Nanotechnology* **4**, 496 (2009).
32. C. C. Neacsu, B. van Aken, M. Fiebig, and M. B. Raschke, "Nonlinear near-field imaging of ferroelectric domain structure in  $\text{YMnO}_3$ ", *Phys. Rev. B (Rapid Commun.)* **79**, 100107R (2009).
31. C. C. Neacsu, S. Berweger, and M. B. Raschke, "Tip-enhanced Raman imaging and spectroscopy: sensitivity, symmetry, and selection rules", *J. Nanobiotechnology* **3**, 172 (2009).
30. R. L. Olmon, P. M. Krenz, A. C. Jones, G. D. Boreman, and M. B. Raschke, "Near-field imaging of optical antenna modes in the infrared", *Optics Express* **16**, 20295 (2008).
29. M. Rang, A. C. Jones, F. Zhou, Z.-Y. Li, B. J. Wiley, Y. Xia, and M. B. Raschke, "Optical near-field mapping of plasmonic nanoprisms", *Nano Lett.* **8**, 3357 (2008).
28. N. Behr and M. B. Raschke, "Optical antenna properties of scanning probe tips: plasmonic light scattering, tip-sample coupling and near-field enhancement", *J. Phys. Chem. C* **112**, 3766 (2008).
27. W. Freyer, C. C. Neacsu, and M. B. Raschke, "Absorption, luminescence, and Raman spectroscopic properties of thin films of benzo-annelated metal-free porphyrazines", *J. Luminescence*, **128**, 661 (2008).
26. C. Ropers, C. C. Neacsu, T. Elsaesser, M. Albrecht, M. B. Raschke, and C. Lienau, "Grating-coupling of surface plasmons onto metallic tips: a nanoconfined light source", *Nano Lett.* **7**, 2784 (2007).
25. P. Gaal, M. B. Raschke, K. Reimann, M. Woerner, and T. Elsaesser, "Measuring optical frequencies in the 0-40 THz range", *Nature Photonics* **1**, 577 (2007).
24. C. C. Neacsu, J. Dreyer, N. Behr, and M. B. Raschke, "Reply to 'Comment on Scanning-probe Raman spectroscopy with single-molecule sensitivity'", *Phys. Rev. B.*, **75**, 236402 (2007).
23. R. M. Roth, N.-C. Panoiu, M. M. Adams, R. M. Osgood, Jr., C. C. Neacsu, and M. B. Raschke, "Plasmon-resonant field enhancement for metallic-probe tips", *Opt. Express*, **14**, 2921 (2006).
22. C. C. Neacsu, J. Dreyer, N. Behr, and M. B. Raschke, "Scanning probe Raman spectroscopy with single molecule sensitivity", *Phys. Rev. B.*, **73**, 193406 (2006).
21. C. C. Neacsu, G. A. Reider, and M. B. Raschke, "Second-harmonic generation from nanoscopic metal tips: Generalized symmetry selection rules for single nanostructures",

*Phys. Rev. B*, **71**, 201402 (2005).

20. C. C. Neacsu, G. Steudle, and M. B. Raschke, "Plasmonic light scattering from nanoscopic metal tips", *Appl. Phys. B*, **80**, 295-300 (2005).
19. A. Hagen, M. Steiner, M. B. Raschke, C. Lienau, T. Hertel, H. Qian, A. J. Meixner, and A. Hartschuh, "Exciton dynamics in individual single-walled carbon nanotubes", *Phys. Rev. Lett.*, **95**, 197401 (2005) (corresponding author, independent collaboration).
18. M. B. Raschke, L. Molina, T. Elsaesser, D. H. Kim, W. Knoll, and K. Hinrichs, "Apertureless near-field vibrational imaging of block-copolymer nanostructures with ultrahigh spatial resolution", *ChemPhysChem*, **6**, 2197-2203 (2005).

#### **PUBLICATIONS (Postdoctoral work)**

17. J. A. McGuire, M. B. Raschke, and Y. R. Shen, "Electron dynamics of silicon surface states: Second-harmonic hole burning on Si(111)7×7", *Phys. Rev. Lett.*, **96**, 087401 (2006).
16. M. B. Raschke and Y. R. Shen, "Nonlinear optical spectroscopy of solid interfaces", *Curr. Op. Sol. State Mat. Science*, **8**, 343-352 (2004).
15. M. B. Raschke and C. Lienau, "Apertureless near-field optical microscopy: tip-sample coupling in elastic light scattering", *Appl. Phys. Lett.*, **83**, 5089-5091 (2003).
14. M. B. Raschke, M. Hayashi, S. H. Lin, and Y. R. Shen, "Doubly-resonant sum-frequency generation for surface studies", *Chem. Phys. Lett.*, **359**, 367-372 (2002).
13. M. Hayashi, S. H. Lin, M. B. Raschke, and Y. R. Shen, "A molecular theory for doubly-resonant IR-UV/vis sum-frequency generation", *J. Phys. Chem. A*, **106**, 2271-2282 (2002).
12. M. B. Raschke and Y. R. Shen, "Lasers in Physics: Sum-frequency generation at surfaces", in *Encyclopedia of Modern Optics*, eds. Guenther et al., Academic Press, London (2002).

#### **PUBLICATIONS (PhD research)**

11. M. B. Raschke and U. Höfer, "Chemisorption energy of hydrogen on silicon surfaces", *Phys. Rev. B*, **63**, 01303/1 (2001).
10. M. Dürr, M. B. Raschke, E. Pehlke, and U. Höfer, "Structure sensitive reaction channels of molecular hydrogen on silicon surfaces", *Phys. Rev. Lett.*, **86**, 123-126 (2001).
9. M. B. Raschke, "Elementary surface reactions of hydrogen and oxygen on silicon: An optical second-harmonic investigation" Utz Verlag, Munich (1999) (ISBN 3-89675-564-1).
8. M. Dürr, M. B. Raschke, and U. Höfer, "Effect of beam energy and surface temperature on the dissociative absorption of H<sub>2</sub> on Si(001)", *J. Chem. Phys.*, **111**, 10411-10414 (1999).
7. M. B. Raschke, "Optical second-harmonic investigations of the kinetics of elementary surface reactions on Si(001) and Si(111)", Dissertation, Technische Universität München (1999).
6. M. B. Raschke and U. Höfer, "Influence of steps and defects on the dissociative adsorption of molecular hydrogen on silicon surfaces", *Appl. Phys. B*, **68**, 649-655 (1999).
5. M. B. Raschke and U. Höfer, "Equilibrium and non-equilibrium hydrogen coverages on vicinal Si(001) surfaces: Diffusion barriers and binding energies", *Phys. Rev. B*, **59**, 2783-2789 (1999).
4. P. Kratzer, E. Pehlke, M. Scheffler, M. B. Raschke, and U. Höfer, "Highly site-specific adsorption of molecular hydrogen on vicinal Si(001) surfaces", *Phys. Rev. Lett.*, **81**, 5596-



5599 (1998).

3. M. B. Raschke, P. Bratu and U. Höfer, "Optical second-harmonic investigations of the isothermal desorption of SiO from Si(100) and Si(111) surfaces", *Surf. Sci.*, **410**, 351-361 (1998).
2. M. B. Raschke and T. E. Madey, "Transmission of low energy ( $\leq 10$  eV) H<sup>+</sup> and D<sup>+</sup> ions through ultrathin rare gas films", *Phys. Rev. B*, **58**, 15832-15837 (1998).
1. M. B. Raschke, "Transmission of low energy ( $\leq 10$  eV) H<sup>+</sup> and D<sup>+</sup> ions through ultrathin rare gas films", M.S. Thesis, Rutgers (1995).

### **INVITED LECTURES & PRESENTATIONS (2009-2015)**

8<sup>th</sup> International Workshop on Infrared Microscopy and Spectroscopy using Accelerator Based Sources, Brookhaven National Laboratory, Oct. 2015, plenary talk, *Synchrotron infrared nano-spectroscopy and -imaging*.

19<sup>th</sup> Symposium on Thermophysical Properties, Boulder, June 2015, *The thermal near-field: coherence, spectroscopy, heat-transfer, and optical forces*.

International Conference on Laser Probing, Michigan State U, June 2015, *Ultrafast nano-optics: probing quantum dynamics at the single emitter level*.

ACS National Meeting, Denver, March 2015, *Multimodal and multispectral nano-imaging: accessing structure underlying the function in molecular and soft-matter*.

PittCon, New Orleans, March 2015, *Vibrational coupling and dynamics from low-temperature tip-enhanced Raman spectroscopy*.

APS March Meeting, San Antonio, March 2015, *Seeing with the nano-eye: accessing structure, function, and dynamics of matter on its natural length and time scales*.

AAAS, San Jose, Feb. 2015, *The SINS of antennas, plasmons, and phonons*.

MRS, Boston, Dec. 2014, *Multimodal and multi-spectral nano-imaging: accessing the structure underlying the function of complex matter*.

DIET 14, Monterey, October 2014, *Nano-focused spectroscopy reaching the single quantum level: imaging structure, function, and dynamics on the nano-scale*.

LNLS, Campinas, Brazil, Sep. 11, 2014, colloquium, *Synchrotron infrared near-field spectroscopy*.

TERS-4, Rio de Janeiro, Sep. 2014, *Vibrational coupling and dynamics from low-temperature tip-enhanced Raman spectroscopy*.

Microscopy & Microanalysis, Hartford, Sep. 2015, *invited talk* (given by postdoc Eric Muller).

BESSY/ISAS, Berlin, July 9., 2014, colloquium, *Multimodal and multi-spectral nano-imaging: accessing the structure underlying the function of complex matter*.

University of Erlangen, Department of Physics, June. 4, 2014, seminar.

University of Bayreuth, June 23, 2014, seminar.

Fritz-Haber Institute, July 2, 2014, department seminar.

CLEO, San Jose, June 2014, *Nano-focused ultrafast spectroscopy and imaging reaching the single quantum level.*

SPIE Europe, Brussels, April 2014, *Ultrafast and nonlinear plasmon dynamics: from strong coupling to coherent control.*

AMOLF, Amsterdam, April 14, 2014, colloquium, *Ultrafast nano-optics: accessing correlation of structure, function, and dynamics of matter on its natural length and time scales.*

Ludwig-Maximilian University Munich, CeNS colloquium, April 11, 2014, *Ultrafast nano-optics: accessing correlation of structure, function, and dynamics of matter on its natural length and time scales.*

MIT, Boston, April 1, 2014, physical chemistry seminar, *Ultrafast nano-optics: accessing correlation of structure, function, and dynamics of matter on its natural length and time scales.*

APS March Meeting, Denver, March 2014, *Multimodal and multi-spectral nano-imaging: accessing the structure, function, and dynamics on the molecular scale.*

University of Wisconsin, Madison, Feb. 18, 2014, *Ultrafast nano-optics: accessing correlation of structure, function, and dynamics of matter on its natural length and time scales.*

Physics of Quantum Electronics (PQE), Snowbird, January 2014, *Ultrafast nano-optics.*

AVS meeting, Long Beach, November 2013, *Multi-modal and multispectral nano-imaging.*

APS Four Corners Section, Denver, Oct. 2014, *Ultrafast nano-optics: accessing structure, function, and dynamics of matter.*

Optics of Surfaces and Interfaces, Chemnitz, September 2013, *Ultrafast and nonlinear spectroscopic nanoimaging at surfaces.*

SciX Conference, Milwaukee, September 2013, *Thermal infrared near-field spectroscopy: coherence, heat-transfer, optical forces, and chemical nano-imaging.*

ACS National Meeting, Symposium Chemistry at the space-time limit, Indianapolis, September 2013, *Nanofocused multimodal imaging, control, and interaction dynamics: Ultrafast spectroscopy reaching the single molecule limit.*

SPIE Photonics West, San Diego, August 2013, *Ultrafast slow light.*

SPIE Photonics West, San Diego, August 2013, *Multimodal and multispectral nano-imaging: accessing the structure underlying the function of polymers, proteins, biominerals.*

Light at the Nanotip, Bad Honnef, August 2013, *Femtosecond Femtosecond nano-focusing on a tip: spatio-temporal pulse shaping, dispersion, and slow light.*

Quantum Effects in Biological Systems, Vienna, July 2013, *Quantum coherent control in the optical near-field.*

Telluride Workshop on Thermal Transport at the Nanoscale, June 2013, *Thermal*

*infrared near-field: vibrational spectroscopy and resonant optical forces.*

Ultrafast Nanooptics, Bad Dürkheim, June 2013, *Ultrafast antenna coupled infrared vibrational dynamics and control.*

Colorado State University, Physical Chemistry Seminar, April 18, 2013, *Multimodal and multispectral nano-imaging: accessing the structure, function, and dynamics in nano-scale soft matter.*

SPIE Ultrafast Phenomena and Nanophotonics XVII, San Francisco, February 2013, *Ultrafast near-field optical control on the nanoscale: impedance matching to quantum systems with optical antennas.* (talk given by postdoc Joanna Atkin on my behalf).

NanoMeta 2013, 4<sup>th</sup> International Topical Meeting on Nanophotonics and Metamaterials, Seefeld, January 2013, *Ultrafast near-field vibrational nano-spectroscopy.*

Argonne National Lab, Nanoscience Colloquium, December 12, 2012, *Antenna-load interactions at optical frequencies: impedance matching to quantum systems.*

MRS Fall Meeting, Boston, November 2012, *Optical scanning probe nano-imaging and ultrafast spectroscopy reaching the single molecule limit.* (canceled, due to flight delay from Hawaii).

Sixth International Symposium on Advanced Science and Technology of Silicon Materials (JSPS Si Symposium), November 2012, Kona, Hawaii, *Nonlinear near-field imaging of strain, order phenomena, and dynamics on the nano-scale.*

Duke University, Chemistry seminar, October 30, 2012, *Controlling optical fields in space and time for IR and Raman nano-imaging and –spectroscopy.*

59<sup>th</sup> AVS International Symposium, American Vacuum Society, Tampa, Florida, October 2012, *Near-field spatio-temporal control of optical fields for spectroscopic nano-imaging: ultrafast spectroscopy reaching the single molecule limit.*

SPIE Optics and Photonics Meeting, San Diego, August 2012, *Ultrafast nano-optics with optical antennas.*

Low Energy Electrodynamics in Solids, Napa Valley, July 2012, *Nano-optical imaging and spectroscopy of mesoscopic phase behavior in quantum systems.*

Seeing at the NanoScale 2012, Bristol, July 2012, *Infrared vibrational nano-imaging and spectroscopy reaching the single molecule limit.*

Physical Electronics Conference (PEC 2012), Dallas, June 2012, *Ultrafast nano-optics for systems materials research.* (talk given by postdoc Rob Olmon on my behalf).

Nonlinear Optics at Interfaces, Telluride conference, Telluride, June 2012, *Ultrafast spectroscopy and control in the optical near-field.*

14<sup>th</sup> International Scanning Probe Microscopy conference, Toronto, June 2012, *Femtosecond spectroscopy on the nano-scale: near-field spatio-temporal imaging of electron and vibration dynamics and control.*

Quantum Optics/CMP seminar, University of Toronto, June 15, 2012, *Ultrafast nano-optics with optical antennas.*

Max-Planck-Institute of Microstructure Physics, Halle, Seminar, June 11, 2012, *Ultrafast nano-optics with optical antennas: controlling light-matter interaction and its dynamics in the near-field*.

Max-Planck-Institute for the Science of Light, Erlangen, Seminar, June 4, 2012, *Ultrafast nano-optics with optical antennas*.

Fritz-Haber-Institute, Berlin, Physical Chemistry Seminar, May 30, 2012, *Nano-optical imaging and spectroscopy of meoscopic order, phases, and domains in quantum matter*.

University of Jena, theoretical seminar, May 24, 2012, *Optical forces in the near-field*.

Abbe School of Photonics, Jena, May 22, 2012, *Scientific misconduct: black and white and a lot of grey*.

University of Jena, Physics colloquium, May 11, 2012, *Ultrafast nano-optics with optical antennas*.

University of Pittsburgh, Nanoscience colloquium, March 23, 2012, *Ultrafast nano-optics with optical antennas*.

Los Alamos National Laboratory (LANL), Los Alamos, January 30, 2012, *Ultrafast nano-optics: imaging with nanometer spatial and femtosecond temporal resolution*.

Nanjing University, Nanjing, China, physics colloquium, January 13, 2012, *Ultrafast nano-optics with optical antennas*.

4th APCTP Workshop on Multiferroics, January 2012, Beijing, Nano-optics meets complex oxides: near-field investigations of domain formation and interactions on the nanoscale.

Saturday Physics Series, University of Colorado, December 3, 2012, *Antennas for light: Spectroscopy on the nanoscale*.

RASEI symposium, Electronic and Optical Characterization of Nanoscale Systems for Renewable Energy, November 11, 2011, *Controlling optical fields in space and time for nanoscale imaging and spectroscopy*.

NIST, Boulder, November 8, 2011, *Controlling optical fields in space and time for nano-imaging and –spectroscopy*.

Rutgers University, Department of Physics, November 1, 2011, *Nano-imaging with optical antennas: domain order in complex oxides*.

Pacific Northwest National Laboratory, EMSL review, October 18, 2011, *Chemical spectroscopy at the space-time limit*.

Federation of Analytical Chemistry and Spectroscopy, FACSS annual meeting, Reno, October 2011, *Controlling optical fields in space and time for IR and Raman nano-imaging and – spectroscopy*.

Microscopy and Microanalysis 2011, Nashville, August 2011, *Tip-enhanced spectroscopy: from Optical Nano-Crystallography to Ultrafast Spectroscopy*.

American Chemical Society, 242<sup>nd</sup> ACS National Meeting, August 2011, *Controlling optical fields in space and time for IR and Raman nano-imaging and –spectroscopy.*

Seeing at the Nanoscale, Santa Barbara, July 2011, *Progress in optical scanning probe microscopy.*

Time Resolved Vibrational Spectroscopy XV, Ascona, June 2011, *Ultrafast vibrational near-field spectroscopy.*

University of Chemnitz, June 15, 2011, colloquium, *Optical antennas for superresolution imaging and spectroscopy.*

University of Central Florida, CREOL, May 31, 2011, *Ultrafast nano-optics.*

5<sup>th</sup> International Conference on Surface Plasmon Photonics (spp5), Busan, Korea, May 2011, *Electric and magnetic field and current of plasmonic antennas: A nano-optical vector network analyzer.*

Seoul University, Department of Physics, May 23, 2011, *Ultrafast nano-optics: controlling light in space and time.*

University of Jena, Institute of Applied Physics, April 28, 2011, *Ultrafast nano-optics.*

University of Dresden, Institute for Applied Photophysics, April 29, 2011, *Ultrafast nano-optics.*

Nonlinear Optics Workshop, Erlangen, April 2011, *Spatio-temporal control of optical fields on the nanoscale.*

National Renewable Energy Laboratory, NREL, April 13, 2011, *Optical antennas for nanoscale imaging and spectroscopy.*

Frontiers in Optics 2010, Rochester, October 24, 2010. *Ultrafast nano-optics: imaging with nanometer spatial and femtosecond temporal resolution.*

Federation of Analytical Chemistry and Spectroscopy Societies (FACSS) meeting 2010, Raleigh, October 27, 2010. *Optical nanocrystallography.*

Seeing at the Nanoscale VIII, Basel, August 30, 2010. *Optics on the Nanoscale: imaging and spectroscopy with optical antennas.*

Vibrational Spectroscopy, Gordon Conference, Biddeford, Maine, August 2, 2010. *Vibrational spectroscopy on the nanoscale.*

Nonlinear Optics at Interfaces, Telluride, June 21, 2010. *Nonlinear optics in the near-field.*

University of Utah, Salt Lake City, March 8, 2010. *Ultrafast nano-optics: imaging with nanometer spatial and femtosecond temporal resolution.*

University of Washington, Veeco Metrology Workshop, October 29, 2009. *Optical antenna on a tip: new routes for near-field imaging.*

Lawrence Berkeley National Laboratory, Molecular Foundry User meeting, Berkeley,

October

17, 2009. *Dynamics on the nanoscale: spatio-temporal imaging and control of light using plasmonics.*

University of California, Berkeley, Department of Materials Science, Berkeley, October 14, 2009. *Transition metal oxides – electronic and structural correlations on the nanoscale.*

Max-Planck-Institute for Quantum Optics, Garching, colloquium, September 15, 2009. *Dynamics on the nanoscale: spatio-temporal imaging and control of light using plasmonics.*

Universität Konstanz, group seminar, Konstanz, September 11, 2009. *Ultrafast and ultra-small: plasmonic field localization and dephasing.*

Universität Stuttgart, Photonics seminar, Stuttgart, September 9, 2009. *Optics on the nanoscale: imaging and spectroscopy with optical antennas.*

University of Washington, NIMS-UW forum, June 12, 2009. *Optics on the nanoscale: imaging and spectroscopy with optical antennas.*

Conference on Lasers and Electro-Optics CLEO/QELS-09, Baltimore, June 4, 2009. *Few-femtosecond electronic dephasing of an individual plasmonic nanostructure.*

Brookhaven National Laboratory, seminar, April 10, 2009. *Infrared nanoimaging for chemical analysis.*

SUNY Stony Brook, Department of Chemistry, April 9, 2009. *Optical nanocrystallography with tip-enhanced phonon Raman spectroscopy.*

Washington State University, Department of Physics, seminar, March 3, 2009. *Dynamics on the nanoscale – how to obtain nanometer spatial and femtosecond temporal resolution.*

University of British Columbia, Department of Chemistry, seminar, February 27, 2009. *IR plasmonics: vector near-field imaging of IR optical antennas.*

University of California, San Diego, seminar, February 18, 2009. *Nano-phase behavior of transition metal oxides: about ferroelectrics, multiferroics, and metal-to-insulator transitions.*

University of Colorado, JILA, seminar, February 9, 2009. *Optical antennas for probing spatiotemporal dynamics on the nanoscale.*

#### **CONFERENCE ORGANIZATION:**

Near-Field Optics, NFO, 2014, Snowbird, Utah, (co-chair with Jim Schuck and Jordan Gerton).

SPIE Conference, 2014, Nanoimaging and Nanospectroscopy (program committee)

(chair Prabhat Verma).

Ultrafast Surface Dynamics, 2013, Colorado (co-chair with Henry Kapteyn, and Xiaoyang Zhu).

Near-Field Optics, NFO, 2012, San Sebastian (international program committee).

OSA Annual Conference, Frontiers in Optics, 2011, San Jose (program chair, nano-optics symposium).

European Optical Society Annual Meeting (EOSAM), Paris, August 2010 (program committee).

University of Washington Center for Nanotechnology Conference on Nanotechnology, Seattle, June 2009 (program committee).

International Conference on Molecular Photonics, University of Washington, Friday Harbor, August 2007 (organizing committee).

International Workshop on Silicon Surfaces – Electronic Structure and Dynamics, Max-Born-Institute, Berlin, September 2005 (co-organizer with Martin Weinelt).

ECOSS 23, European Conference on Surface Science, Berlin, September 2005 (organizing committee, symposium organization).

## **REFEREE**

Journal: Physical Review, Physical Review Letters, Nature, Nature Nanotechnology, Nature Photonics, Journal of Physical Chemistry, Surface Science, and New Journal of Physics

Proposal review for NSF, NIH, DoE, ACS PRF, German Israel Foundation

## **UNIVERSITY SERVICE**

*University of Colorado:* Chair Chemical Physics PhD Program; Colloquium Committee (member, chair); Faculty advisory Industry Taskforce; Graduate admissions (member); University level: Industrial Advisory Committee (member); Research Review Board (member); Standing Committee on Research Misconduct (member).

*University of Washington:* Graduate Recruiting/Admissions Committee, Space Committee, Physical Chemistry Graduate Exam Committee, Condensed Matter Search Committee Member

## **TEACHING**

*University of Colorado:*

PHYS 1120: Tutorial in Introductory Physics, fall 2010

PHYS 7810: Graduate Nonlinear Optics, spring 2011, spring 2012, spring 2015

PHYS 1140: Experimental Physics, fall 2011, fall 2012, fall 2015

PHYS 7810: Graduate Ultrafast Spectroscopy, spring 2012, spring 2016

PHYS 4510: Optics, fall 2013, fall 2014

*University of Jena:*

Introduction to Nano-Optics, May/June 2012, co-taught with Thomas Pertsch.

*University of Washington:*

CHEM 484: Materials Chemistry/Solid State Physics, Autumn 2008, 2009, 2010

CHEM 457: Statistical Thermodynamics, Spring 2007, 2008, 2009

CHEM 520: Special Topics in Analytical and Physical Chemistry (Nano-optics and spectroscopy), Winter 2007, 2008

*Humboldt University/Free University Berlin*

Condensed Matter Physics, Free University, Berlin, Summer semester 2006

Physics Lab: Nonlinear Optics, Humboldt University, Summer/Winter 2002-2006

## **MENTORING**

### **Current Postdocs:**

Eric Muller, PhD UC Berkeley (advisor: Charles Harris): ultrafast vibration dynamics in near-field, synchrotron nano-spectroscopy.

Omar Khatib, PhD UC San Diego (advisor: Dmitry Basov): near-field pump-probe.

Ronald Ulbricht, PhD FOM Institute AMOLF (advisor: Mischa Bonn): near-field coherent control.

Sibel Yalcin, PhD University of Massachusetts, Amherst (advisor: Marc Achermann): bio-imaging (postdoc at EMSL/PNNL).

### **Current graduate students:**

Ben Pollard, since 9/2011, physics: IR-vib spatio-spectral imaging, soft-matter, optical antennas

Brian O'Callahan, since 9/2011, physics: correlated electron materials, ultrafast, thermal near-field

Vasily Kravtsov, since 03/2012, physics: nano-Raman, ultrafast plasmon dynamics

Sven Dönges, since 9/2014, physics: ultrafast pump-probe, correlated matter

Kyoung-Duck Park, since 9/2013, EECE: cryo-TERS/SHG, ferroics, single molecules



### **Current undergraduate students (honors program)**

Jason Van Fossom, since 1/2014: (joint supervision with Joe Smyth, geophysics), REE geochemistry and crystallography

Peter Van Blerkom, BS/MS, since 5/2014: single crystal X-ray diffraction (UG research, joint supervision with Joe Smyth, geophysics), nano-optics (MS)

Jared Stanley, since 8/2013: thermal near-field

Evan Anderson, since 7/2013: mineral physics

Daniel Hammerland, since 1/2013: cryo-SHG

Meaghan Daly, since 10/2012: ultrafast pump-probe

### **Past undergraduate students (honors program, UCB only)**

Paul Sass, 2/2012 – 5/2013, magna cum laude, *Tip-enhanced Raman spectroscopy for nanometer spatially resolved spectroscopic imaging* [65, 66]

Justin Gerber, 1/2011 – 5/2013: summa cum laude, *Real-time detection for scattering scanning near-field optical microscopy* [61, first author]

Evan Jasper, 12/2011 – 5/2012, magna cum laude, *Intrapulse difference frequency generation in gallium selenide*.

Molly May, 10/2011 – 4/2012, summa cum laude, *Development of a low temperature microscope for the study of correlated materials*.

### **Other (non-honors, REU, international exchange):**

Silke Möbius, DAAD RISE, Göttingen, since 9/2014

Jonas Allerbeck, DAAD RISE exchange student, BS thesis, Konstanz, 7/2013-2/2014: Ultrafast vibrational dynamics in the near-field.

Thomas Kämpfe, DAAD RISE, Dresden, since 9/2014

Philip Persson, BA geology, UCB, 3/2011 – 11/2011, petrology of REE pegmatites, co-adviser Charles Stern, geology.

Erik Hebestreit, DAAD RISE exchange student, BS thesis, Jena, 9/2010-6/2011: Development of cryogenic near-field microscopy [50, co-author].

Fehmi Yasin, REU, 2013: Near-field signal detection.

Simon Hannibal, DAAD RISE, 2011: Plasmon near-field imaging.

Emily Chavez, REU, 2011: VO<sub>2</sub> phase behavior [45, co-author].

Eric Josberger, UW and UCB, 3/2008 – 4/2012: Low-temperature near-field microscopy,

7-8 2012 EMSL/PNNL: instrument commissioning for user facility  
Julie Cass, REU, UW, 2010: Low-temperature near-field microscopy  
Brent Crabtree, UW, 4/2009 – 11/2009: Optical parametric amplifier development  
Rachel Hinman, REU, UW, 2009: Near-field spectroscopy

**Students graduated MS/PhD; former postdocs:**

Catalin Neacsu, PhD 2007, Femtolasers Inc.,  
Alexandria Anderson, MSc 2009, Femtolasers Inc., currently Max-Born-Institute  
Kseniya Deryckx, MSc 2010, UW Medical School.  
Samuel Berweger, PhD 2011, Postdoc Anasys Inc., currently NIST Boulder  
Robert Olmon, PhD 2012, Intel.  
Andrew Jones, PhD 2012, Femtolasers Inc.  
Xiaoji Xu, Postdoc 2009-2011, Assistant Professor, Lehigh University.  
Ryan Murick, Postdoc 2010, RHK.  
Ian Craig, Postdoc 2011-2012, Staff PNNL.  
Joanna Atkin, Postdoc 2010-2014, Assistant Professor.  
Honghua Yang, PhD 2015, Anasys Inc.

**PROFESSIONAL SOCIETIES**

Lifetime Member and Fellow American Physical Society, Lifetime Member and Fellow American Optical Society. Member of American Chemical Society, American Geological Society, American Mineralogical Society, and the Deutsche Physikalische Gesellschaft.