

SOPHIA E. HAYES

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Professional Positions

- 2008 - Associate Professor of Chemistry, Washington Univ., St. Louis, MO
- 2008 - Member, International Center for Advanced Renewable Energy & Sustainability, (I-CARES) Washington Univ.
- 2004 - Member, Center for Materials Innovation (CMI), Washington Univ.
- 2001-2008 Assistant Professor of Chemistry, Washington Univ.
- 2001 Alexander von Humboldt Postdoctoral Research Fellow, Department of Physics, University of Dortmund, 44221 Dortmund, Germany. Advisor: Prof. Dieter Suter
- 1998-2000 Directorate Postdoctoral Fellow, Lawrence Livermore National Laboratory, Livermore, CA and Dept. of Chemical Engineering, University of California, Berkeley, CA. Advisors: Dr. Glenn Fox (LLNL) Prof. Jeffrey A. Reimer (UC Berkeley)
- 1993-1998 Graduate Research and Teaching Assistant, Department of Chemistry, Univ. of California, Santa Barbara, CA. Advisors: Prof. Hellmut Eckert and Dr. William R. Even
- 1993 Summer Intern, Sandia National Laboratories, Livermore, CA. Advisor: Dr. William R. Even
- 1990-1993 Associate, Hagler, Bailly, Inc. (an energy and environmental consulting firm), San Francisco, CA

Education

- 1999 Ph.D., Chemistry, University of California, Santa Barbara
Advisors: Prof. Hellmut Eckert and Dr. William R. Even (Sandia Nat'l Labs). Thesis title:
Lithium intercalation of amorphous carbons: a solid state NMR study of structure and electronic properties
- 1990 B.S., Chemistry, University of California, Berkeley

Awards and Honors

- Chair-Elect, Gordon Research Conference on Magnetic Resonance, 2013 (Vice Chair, 2011)
- Regitze R. Vold Memorial Prize, 2009
- ACS Progress/Dreyfus Lectureship, 2008
- Alfred P. Sloan Research Fellow, 2007-2009
- Washington Univ. Graduate Student Senate Special Recognition for Excellence in Mentoring, 2004
- NSF Early Career Development (CAREER) Award, 2003
- Alexander von Humboldt Research Fellow, Dept. of Physics, Univ. of Dortmund, Germany, 2001
- Directorate Postdoctoral Fellow, Lawrence Livermore National Laboratory, 1998-2000
- Chemistry and Materials Science Directorate Award, Lawrence Livermore National Lab, 1999
- Executive Vice Chancellor's International Fellowship, Materials Research Lab, UCSB, 1998
- University of California President's Dissertation Year Fellowship for Physical Sciences, 1997-1998
- UCSB Graduate Division Travel Grant, 1997
- UC-wide James D. Kline Fellowship for International Studies, at Univ. of Münster, Germany, 1996
- Robert H. DeWolfe Teaching Award, UCSB, 1995

Research Interests

Development and application of optically-pumped (OPNMR) and optically-detected (ODNMR) NMR techniques--these methods are applied to semiconductors, to gain insight into the interplay between photoexcitation and electron spin polarization. Surface and interface structures in the materials and spin diffusion processes that can polarize distant spins are being studied. These research foci have particular relevance to solar energy materials and solid-state lighting applications.

Solid state NMR spectroscopy with *in situ* optical excitation for the characterization of molecular optical switch materials--model systems of single-crystal organic species and supramolecular complexes are the current research focus, and these are analyzed to assess structure, including solid-state packing effects, crystalline or polymorphic phases, fatigue resistance, and the wavelength and temperature dependence of the photoreaction kinetics.

NMR studies on systems of inorganic molecular species and clusters (i.e., II-VI semiconductor nanocrystals and hexarhenium clusters and their analogues), focusing especially on ^{77}Se , ^{113}Cd , and ^{31}P .

Publications (* indicates corresponding author)

22. Ramaswamy, Kannan; Mui, Stacy; Crooker, Scott A.; Pan, Xingyuan; Sanders, Gary D.; Stanton, Christopher J.; *Hayes, Sophia E. "Optically Pumped NMR: A high resolution tool for measuring the spin-dependent bandstructure in semiconductors" submitted to *Phys. Rev. Lett.*, **2009**.
21. Mui, Stacy; Ramaswamy, Kannan; Crooker, Scott A.; Pan, Xingyuan; Sanders, Gary D.; Stanton, Christopher J.; *Hayes, Sophia E. "Manifestation of Landau Level Effects in Optically-pumped NMR of Semi-insulating GaAs", special issue of *Phys. Chem. Chem. Phys.*, **2009**, *11*, 7031-7035. doi:10.1039/b907588g. Cover: *Phys. Chem. Chem. Phys.*, **2009**, *11*, 6862. doi: 10.1039/b914904j <http://www.rsc.org/Publishing/Journals/CP/article.asp?doi=b907588g>
20. Fonseca, Isa; Hayes, Sophia E.; *Bertmer, Marko "Size effects of aromatic substitution in the ortho position on the photodimerization kinetics of α -trans cinnamic acid derivatives. A solid-state NMR study" accepted or publication, *Phys. Chem. Chem. Phys.*, **2009**. doi: 10.1039/b911127a.
19. Nieuwendaal, Ryan C.; Bertmer, Marko; *Hayes, Sophia E. "An unexpected phase transition during the [2+2] photocycloaddition reaction of cinnamic acid to truxillic acid: Changes in polymorphism monitored by solid-state NMR" *J. Phys. Chem. B* **2008**, *112*, 12920-12926. doi: 10.1021/jp806218u <http://dx.doi.org/10.1021/jp806218u>
18. Fonseca, Isa; Hayes, Sophia E.; Blümich, Bernhard; *Bertmer, Marko "Temperature stability and photodimerization kinetics of β -cinnamic acid and comparison to its α polymorph as studied by solid-state NMR spectroscopy techniques together with DFT calculations" *Phys. Chem. Chem. Phys.* **2008**, *10*, 5898-5907. doi: 10.1039/b806861e <http://www.rsc.org/Publishing/Journals/CP/article.asp?doi=b806861e>
17. Mui, Stacy; Ramaswamy, Kannan; *Hayes, Sophia E. "Physical insights from a penetration depth model of optically-pumped NMR," *J. Chem. Phys.* **2008**, *128*, 052303/1-7. doi:10.1063/1.2816783 <http://link.aip.org/link/?JCPA6/128/052303/1>
16. *Hayes, Sophia E.; Mui, S.; Ramaswamy, K. "Optically pumped nuclear magnetic resonance of semiconductors," (invited review article) *J. Chem. Phys.* **2008**, *128*, 052203/1-17. doi: 10.1063/1.2823131 <http://link.aip.org/link/?JCPA6/128/052203/1>
15. Mui, S.; Ramaswamy, K.; *Hayes, S.E. "Effects of optical absorption on ^{71}Ga optically polarized NMR in semi-insulating GaAs: measurements and simulations," *Phys. Rev. B* **2007**, *75*, 195207/1-8. doi:10.1103/PhysRevB.75.195207 <http://link.aps.org/doi/10.1103/PhysRevB.75.195207>
14. Ramaswamy, K.; Tulsy, E.G.; Long, J.R.; Kao, J. L.-F.; *Hayes, S.E. "Determination of ^{77}Se - ^{77}Se and ^{77}Se - ^{13}C *J*-coupling Parameters for the Selenocyanide Clusters $[\text{Re}_5\text{OsSe}_8(\text{CN})_6]^{3-}$ and $[\text{Re}_4\text{Os}_2\text{Se}_8(\text{CN})_6]^{2-}$ " *Inorg.*

- Chem.* **2007**, *46*, 1177-1186. doi:10.1021/ic061571g
<http://dx.doi.org/10.1021/ic061571g>
13. Ramaswamy, K.; Mui, S.; *Hayes, S.E. "Light-induced hyperfine ^{69}Ga shifts in semi-insulating GaAs by optically polarized NMR" *Phys. Rev. B* **2006**, *74*, 153201/1-4. [Erratum: *Phys. Rev. B* 2007, 75, 249903]. doi:10.1103/PhysRevB.74.153201
<http://link.aps.org/doi/10.1103/PhysRevB.74.153201>
 12. Bertmer, M.; Nieuwendaal, R.C.; Barnes, A.B.; *Hayes, S.E. "Solid-State Photodimerization Kinetics of α -*trans*-Cinnamic Acid to α -Truxillic Acid Studied via Solid-State NMR" *J. Phys. Chem. B* **2006**, *110*, 6270-6273. doi:10.1021/jp057417h
<http://dx.doi.org/10.1021/jp057417h>
 11. *Ma, G.; Fischer, A.; Ramaswamy, K.; *Hayes, S.E. "Cd(II)-ethylenediamine Mono- and Bimetallic Complexes—Synthesis and Characterization by ^{113}Cd NMR Spectroscopy and Single Crystal X-ray Diffraction" *Inorg. Chim. Acta* **2005**, *358*, 3165-3173. doi:10.1016/j.ica.2005.04.029
 10. Ma, G.; *Hayes, S.E. "Microwave-enhanced, solvent-free synthesis of singly and doubly ^{13}C -labelled *trans*-cinnamic acid at the α - and β -carbon positions" *J. Labelled Compd. Rad.* **2004**, *47*, 895-901. doi:10.1002/jlcr.878
<http://www3.interscience.wiley.com/journal/109610034/abstract>
 9. Eickhoff, M.; Lenzman, B.; *Suter, D.; Hayes, S.E.; Wieck, A.D. "Mapping of Strain and Electric Fields in GaAs/Al_xGa_{1-x}As Quantum Well Samples by Laser Assisted NMR" *Phys. Rev. B* **2003**, *67*, 085308/1-5. doi:10.1103/PhysRevB.67.085308
<http://link.aps.org/doi/10.1103/PhysRevB.67.085308>
 8. Paravastu, A.K.; Hayes, S.E.; Schwickert, B.; *Reimer, J.A.; Dinh, L.N.; Balooch, M. "Optical polarization of nuclear spins in GaAs" *Phys. Rev. B* **2004**, *69*, 075203/1-8. doi:10.1103/PhysRevB.69.075203
<http://link.aps.org/doi/10.1103/PhysRevB.69.075203>
 7. *Hayes, S.E.; Guidotti, R.; Even, W.R., Jr.; Hughes, P.J.; Eckert, H. " ^7Li solid-state nuclear magnetic resonance as a probe of lithium species in microporous carbon anodes" *J. Phys. Chem. A* **2003**, *107*, 3866-3876. doi:10.1021/jp021772f
<http://dx.doi.org/10.1021/jp021772f>
 6. Dinh, L.N.; Hayes, S.E.; Wynne, A.E.; Wall, M.A.; Saw, C.K.; Stuart, B.C.; *Balooch, M.; Paravastu, A.K.; Reimer, J.A. "Properties of GaAs nanoclusters deposited by a femtosecond laser" *J. Mater. Sci.* **2002**, *37*, 3953-3958. doi:10.1023/A:1019680111363
<http://www.springerlink.com/content/k0458v7516811627/?p=feadc35e63cd4ee6a82e295f4663e215&pi=17>
 5. Rosenhahn, C.; Hayes, S.E.; Rosenhahn, B.; *Eckert, H. "Structural organization of arsenic selenide glasses: new results from liquid state NMR" *J. Non-Cryst. Solids* **2001**, *284*, 1-8. doi:10.1016/S0022-3093(01)00371-4
 4. Rosenhahn, C.; Hayes, S.E.; Brunklaus, G.; *Eckert, H. "Network stiffening and chemical ordering in chalcogenide glasses: compositional trends of T_g in relation to structural information from solid and liquid state NMR". *Phase Transitions and Self-Organization in Electronic and Molecular Networks*; J.C. Phillips, M.F. Thorpe, Eds.; Kluwer Academic/Plenum Publishers: New York, May 2001; p. 123-141.
 3. Dinh, L.N.; Hayes, S.; Schildbach, M.A.; Saw, C.; McLean, W.; *Balooch, M.; Reimer, J.A. "GaAs nanostructures and films deposited by a Cu-vapor laser" *Appl. Phys. Lett.* **1999**, *75*, 2208-2210. doi:10.1063/1.124966
<http://link.aip.org/link/?APPLAB/75/2208/1>
 2. Hayes, S.E.; Even, W.R., Jr.; Guidotti, R.; *Eckert, H. "Structural and electrochemical characterization of glassy carbon prepared from silicon-doped polymethacrylonitrile/divinylbenzene copolymer" *J. Electrochem. Soc.* **1999**, *146*, 2435-2442. doi:10.1149/1.1391952
<http://dx.doi.org/10.1149/1.1391952>

- Hayes, S.; van Wüllen, L.; *Eckert, H.; Even, W.R., Jr.; Crocker, R.W.; Zhang, Z. "Solid state NMR strategies for the structural investigation of carbon-based anode materials" *Chem. Mater.* **1997**, *9*, 901-911. doi:10.1021/cm960389i <http://dx.doi.org/10.1021/cm960389i>

Patents

- Hayes, S.E.; Ramaswamy, K.; Mui, S. U.S. Provisional Patent "Spectroscopic Identification of Defects in Semiconductors Through Optically-Pumped Nuclear Magnetic Resonance" Ref: 009039-PRO1.
- Hayes, S.E.; Ramaswamy, K.; Mui, S. "Absorption Edge Tuning of Semiconductors" patent being prepared, submitted 2008.

Research Support

Funded Support:

- 2009-2012 **NSF Major Research Instrumentation (0923413)**, "MRI: Development of Combined Optically-pumped and Optically-detected NMR of Bulk and Nanostructured Semiconductors"
- 2007-2009 **Alfred P. Sloan Foundation Research Fellow**
- 2007-2009 **National High Field Magnetic Laboratory, Los Alamos**, "Magneto-Absorption Studies of Semiconductors with Circularly Polarized Light" (time on special apparatus to measure optical properties at high static, variable, magnetic fields).

Completed Support:

- 2008-2009 **ICARES (WU)**, "Understanding the role of defects in reducing photovoltaic efficiency of silicon solar cells—probed by optically pumped NMR"
- 2007-2009 **Center for Materials Innovation (WU)**, "Low Bandgap Semiconductor Materials for Multiple Exciton Generation" with Profs. Bill Buhro, Rich Loomis (Chemistry). Collaborative research to investigate surface chemistry of II-VI nanowires and study these by both NMR and optical spectroscopy for MEG applications.
- 2006-2007 **Army Research Office**, "Laser-Enhanced NMR of Semiconductor Nanostructures." Study initiated to study InP nanowires by OPNMR.
- 2006-2007 **Center for Materials Innovation (WU)**, "Epitaxial Ferromagnetic Nitride Semiconductor Heterostructures," with Profs. Mark Conradi, Dan Leopold, and Jim Schilling (Physics). Collaborative research to make ferromagnetic quantum wells based on GaN and initiate NMR and magnetic susceptibility studies.
- 2003-2006 **Army Research Office**, Defense University Research Instrumentation Program (DURIP) "Design and construction of an apparatus for combined optically-polarized and optically-detected NMR to study semiconductor heterostructures." Equipment funding to build an apparatus for combined OPNMR and ODNMR, for the study of semiconductor materials.
- 2004-2006 **Petroleum Research Fund**, Type G, "Study of topochemical photoconversion of cinnamic acid to truxillic acid via solid-state NMR with *in situ* optical irradiation." Research into topochemical solid-state photoreactions in organic molecular crystals and powders by ¹³C NMR.
- 2004-2007 **Center for Materials Innovation**, "Single-Nanostructure Spectroscopy and Transport," with Profs. Bill Buhro, Rich Loomis (Chemistry) and Stuart Solin (Physics). Collaborative research to synthesize III-V nanowires and characterize these by a combination of solid-state NMR and optical spectroscopy.
- 2004-2006 **Center for Materials Innovation**, "Environmental Impact of Nanoparticles," with Profs. Pratim Biswas and Dan Giammar, (Environmental Engineering). Collaborative research to study heavy metal sorption (Pb, U) by nanoparticles, especially TiO₂, for environmental remediation purposes.
- 2003-2008 **NSF/Career**, "Spectroscopic studies of interface structure and strain in low-dimensional semiconductor heterostructures by laser-enhanced nuclear magnetic resonance." Research to develop optically-polarized (-pumped) and optically-detected techniques to probe semiconductors, especially multilayered heterostructures.

- 2000-2001 (postdoc) **Lawrence Livermore National Laboratory Lab**-Directed Research Dollar Renewal, "Optically-polarized NMR of bulk and quantum-confined GaAs," (P.I.: Hayes).
- 1999-2000 (postdoc) **Lawrence Livermore National Laboratory Lab**-Directed Research Dollars Grant, "Optically-polarized NMR of semiconductor nanoclusters," (P.I.: Hayes).
- 1994-1998 (grad school) **Sandia National Laboratories** grant, "NMR studies of lithium intercalation of microporous carbons," (grant awarded to Hayes to fund 4 years of graduate study).

Invited Presentations (since 2001)

41. Regitze R. Vold Memorial Lecture, Alpine Conference on Solid-state NMR, Chamonix, France, Sept. 2009. "A New Model of Optically-pumped NMR in Direct-Gap Semiconductors."
40. Gordon Research Conference, Magnetic Resonance, Biddeford, ME, June 2009. "OPNMR of GaAs: Roadmaps for New Routes through the Opto-Electronic 'Landscape'."
39. Univ. of California, Santa Cruz, March 2009. "Studying defects and photogenerated carriers in semiconductors with light + NMR -- prospects for solar energy applications." (departmental seminar)
38. St. Olaf College, MN, Feb. 2009. "Studying defects and photogenerated carriers in semiconductors with light + NMR -- prospects for solar energy applications." (departmental seminar, Pew Midstates Consortium-funded)
37. Kavli Foundation and Nat'l Academy of Sciences "Frontiers of Science" conference, Roscoff, France, Nov. 2008. "Electron-Nuclear Interactions in Semiconductors: Probed via Optically-Pumped NMR" (invitation-only conference, poster presentation)
36. MEMC, St. Peters, MO, Nov. 2008. "Optically-pumped NMR of semiconductors: a new analysis tool for semiconductors."
35. Northwestern Univ., Dept. of Chemistry, Evanston, IL, Oct. 2008. "Optically-Pumped NMR of Semiconductors: Probing Defect Sites and the Band Structure of GaAs" (departmental seminar).
34. Univ. of IL Chicago, Dept. of Chemistry, Chicago, IL, Oct. 2008. "Optically-Pumped NMR of Semiconductors: Probing Defect Sites and the Band Structure of GaAs" (departmental seminar).
33. Mt. Holyoke, Dept. of Chemistry, South Hadley, MA, Sept. 2008. "Solid-State NMR with Light Added -- Possibilities for Materials Science" (departmental seminar).
32. Dortmund University, Dept. of Physics, EIIIa, Germany, May 2008. "Optically-pumped NMR of semiconductors: probing the bandstructure and defect sites in GaAs" (departmental seminar).
31. Univ. of Florida, Dept. of Chemistry, Gainesville, FL, Nov. 2007. "Laser-enhanced NMR of semiconductors" (departmental seminar).
30. M.I.T., Dept. of Chemistry, Cambridge, MA, Oct. 2007. "Optically-pumped NMR of semiconductors: probing the bandstructure and defect sites in GaAs" (departmental seminar).
29. Southern Illinois Univ. Carbondale, Dept. of Chemistry, Carbondale, IL, Sept. 2007. "Optically-pumped NMR of semiconductors" (departmental seminar).
28. Cornell University, Dept. of Chemistry, Ithaca, NY, Feb. 2007. "Electron-Nuclear Interactions Probed by ^{69}Ga and ^{71}Ga OPNMR of Semi-Insulating GaAs" (departmental seminar).
27. Ithaca College, Dept. of Chemistry, Ithaca, NY, Feb. 2007. "Solid-state Photodimerization of Cinnamic Acid--a Study of Topochemistry by ^{13}C NMR" (departmental seminar).
26. ACS Midwestern Regional Meeting, Quincy, IL, Oct. 2006. "Probing the Electronic Band Structure of GaAs with NMR" (invited talk).
25. Gordon Research Conference, Inorganic Chemistry, Newport, RI, June 2006. "OPNMR of ^{69}Ga in Bulk GaAs" (invited talk).

24. Univ. of Washington, Dept. of Chemistry, Seattle, WA, May 2006. "Optically-Induced Hyperfine Shifts in OPNMR of ^{69}Ga in Bulk Semi-insulating GaAs" (departmental seminar).
23. Hope College, Dept. of Chemistry, Holland, MI, March 2006. "Topochemical Reactions Monitored by Solid-State NMR" (departmental seminar).
22. Calvin College, Dept. of Chemistry, Grand Rapids, MI, March 2006. "Topochemical Reactions Monitored by Solid-State NMR" (departmental seminar).
21. Univ. of Calif. Santa Barbara, Materials Department & MRL, CA, March 2006. "OPNMR of ^{69}Ga in Bulk Semi-insulating GaAs" (interdepartmental IGERT seminar).
20. Univ. of Calif. Santa Barbara, Univ. of Calif. Santa Barbara, CA, March 2006. "Topochemical Reactions Monitored by Solid-State NMR" (departmental seminar).
19. High Field Solid State NMR Workshop, College of William & Mary, Williamsburg, VA, March 2006. "OPNMR of ^{69}Ga in Bulk Semi-insulating GaAs" (invited talk).
18. Alpine Conference on Solid-State NMR, Chamonix, France, Sept. 2005. "OPNMR of Ga-69 in GaAs in Bulk Single Crystals and in Heterostructured Devices" (invited talk).
17. Experimental NMR Conference (ENC), Providence, RI, April 2005. "OPNMR of Ga-69 in n-, p-, and Semi-Insulating-GaAs and Heterostructured InGaP/GaAs" (invited talk).
16. Univ. of Arkansas, Dept. of Physics, Fayetteville, AR, April 2005. "OPNMR of Ga-69 in n-, p-, and Semi-Insulating-GaAs and Heterostructured InGaP/GaAs" (departmental seminar).
15. St. Louis NMR Discussion Group, March, 2005. "OPNMR of ^{69}Ga spins in GaAs in Semi-insulating GaAs and In GaP/GaAs Heterostructures" (invited talk).
14. Univ. of Missouri St. Louis, Dept. of Chemistry, MO, Jan. 2005. "Solid Solid-state NMR of Crystalline Optical Memory/Optical Switch Materials" (departmental seminar).
13. Univ. of Missouri, Rolla, Dept. of Chemistry, MO, Nov. 2004. "Solid-state photochemistry combined with NMR--towards optical memory materials" (departmental seminar).
12. NSF Workshop on Materials Chemistry and Nanoscience, Broomfield, CO, Oct. 2004. "Laser Enhanced NMR of Semiconductor Nanostructures" (invited talk).
11. ISMAR, Triennial Conference for the Intl Society of Magnetic Resonance, Jacksonville, FL, Oct. 2004. "NMR with Optical Pumping of III-V Semiconductor Heterostructures" (invited talk).
10. Southern Illinois University Edwardsville, Dept. of Chemistry, IL, Sept. 2004. "Towards Materials for Optical Memory and Optical Switches: Nucleation and Growth Kinetics of [2+2] Cycloadditions Studied by Solid-state NMR" (departmental seminar).
9. Florida State University, Dept. of Chemistry, and Nat'l High Magnetic Field Lab (NHMFL), Tallahassee, FL, Sept. 2004. "Laser-enhanced NMR for the Study of Semiconductors" and "Optical Solid-state Nucleation and Growth Kinetics in a Model 'Optical Switch' Studied by Solid-state NMR" (departmental seminar).
8. Rocky Mountain NMR Conference, Denver, CO, July 2004. "Photo-induced nucleation and growth processes in crystalline [2+2] cycloadditions reactions—a model 'optical switch' compound" (invited talk).
7. RWTH Aachen University, Macromolecular Chemistry Dept., Aachen, Germany, May 2004. "Optical Pumping of GaAs—Some New Insights into Polarization" (departmental seminar).
6. Dortmund University, Dept. of Physics, Dortmund, Germany, May 2004. "Solid-state Nucleation and Growth Kinetics in a Model 'Optical Switch' Studied by Solid-state NMR" (Graduate College seminar).
5. Inst. of Physical Chemistry, University of Münster, Germany, May 2004. "Solid-state Nucleation and Growth Kinetics in a Model 'Optical Switch' Studied by Solid-state NMR" (departmental seminar).

4. Washington Univ., Dept. of Physics, St. Louis, MO, Dec. 2002. "Laser-enhanced NMR: New Tools for the Study of Semiconductors" (departmental seminar).
3. St. Louis University, Dept. of Chemistry, St. Louis, MO, Oct. 2002. "Laser-enhanced NMR of semiconductors" (departmental seminar).
2. Southwest Missouri State University, Dept. of Chemistry, Branson, MO, Oct. 2002. "Laser-enhanced NMR of semiconductors." (departmental seminar)
1. University of Missouri Columbia, Dept. of Chemistry, MO, Nov. 2001. "Laser-enhanced NMR of semiconductors" (departmental seminar).

Contributed Presentations (since 2001)

23. RMC (Rocky Mountain Conference on Analytical Chemistry), Snowmass, CO, Aug. 2009. "Spin-dependent Splitting of the GaAs Bandstructure: Fine Structure from a Combination of OPNMR, Magnetoabsorption, and Theoretical Calculations" (contributed talk).
22. ENC (Experimental NMR Conference), Asilomar, CA, March 2009 "A New Model of Optical-Pumping Phenomena in Semiconductors" (contributed poster).
21. American Physical Society (APS) March Meeting, Pittsburgh, PA, March 2009 "A New Model of Optical-Pumping Phenomena in Semiconductors" (contributed talk)
20. ACS Nat'l Meeting, Philadelphia, PA, Aug. 2008 "Interrogation of the GaAs Electronic Bandstructure: Building on the 'Penetration Depth Model' of Optically-pumped $^{69/71}\text{Ga}$ NMR of GaAs" (promoted talk)
19. RMC, Breckenridge, CO, July 2008 "Probing the Band Structure and Landau Levels in GaAs via Optically-Polarized $^{69/71}\text{Ga}$ NMR" (promoted talk)
18. ENC, Asilomar, CA, March 2008 "Probing the Band Structure and Landau Levels in GaAs via Optically-Polarized $^{69/71}\text{Ga}$ NMR" (promoted talk) "Interrogation of the GaAs Electronic Bandstructure: Building on the "Penetration Depth Model" of Optically-pumped $^{69/71}\text{Ga}$ NMR of GaAs" (contributed poster), and "The [2+2] Photodimerization of \square -trans-Cinnamic Acid to \square -Truxillic Acid: 'Tail' irradiations and Polymorphism" (contributed poster).
17. Chicago Area NMR Meeting, Nov. 2007, "Laser-enhanced NMR of semiconductors: probing the bandstructure and defect sites in GaAs" (contributed talk).
16. GRC, Inorganic Chemistry, Newport, RI, July 2007, "Se-Se J -couplings in Hexarhenium Analogues" and "Surface- and Defect-Sensitive NMR of Semiconductors" (posters).
15. GRC, Magnetic Resonance, Biddeford, ME, June 2007, "Measurements and Simulations of the Photon Energy Dependence of OPNMR in Semi-insulating GaAs" (poster).
14. Canadian Society of Chemistry conference, Winnipeg, Canada, May 2007, "Measurements and Simulations of the Photon Energy Dependence of OPNMR in Semi-insulating GaAs" (contributed talk).
13. ENC, Daytona Beach, FL, April 2007 "Measurements and Simulations of the Photon Energy Dependence of OPNMR in Semi-insulating GaAs" (poster).
12. PCSI (Physics & Chemistry of Semiconductor Interfaces) Conference, Salt Lake City, UT, January 2007, "Measurements and Simulations of the Photon Energy Dependence of OPNMR in Semi-insulating GaAs" (poster).
11. RMC, Breckenridge, CO, July 2006, "Light Induced Hyperfine Shifts in OPNMR of ^{69}Ga in Semi-Insulating GaAs" (poster).
10. ENC Conference, Asilomar, CA, April 2006, "Knight Shifts in OPNMR of ^{69}Ga in Semi-Insulating GaAs" and "Solid-state Photochemistry: Topochemical (Stereochemical) Control of Products in Cycloaddition Reactions" (posters).

9. Missouri Inorganic Day, St. Louis, MO, May 2005, "Laser-Enhanced NMR of GaAs and Its Heterostructures" (contributed talk).
8. PCSI Conference, Bozeman, MT, January 2005, "Laser-enhanced NMR: Spectroscopy of Ga-69 Nuclear Spins in GaAs Semiconductor Heterostructures" (oral and poster).
7. GRC, Solid-State Chemistry, New London, NH, July 2004, "Monitoring topochemical solid-state photodimerizations via solid-state NMR" and "Determination of ^{77}Se - ^{77}Se and ^{77}Se - ^{13}C J -coupling parameters for the C_{4v} -symmetry selenocyanide cluster $[\text{Re}_5\text{OsSe}_8(\text{CN})_6]^{3-}$ " (posters).
6. PCSI Conference, Kona, HI, January 2004, "Nuclear Magnetic Resonance with Optical Pumping of III-V and II-VI Semiconductors" (oral and poster).
5. Chicago Area NMR Meeting, Chicago, IL, November 2003, "Solid-state NMR of photodimerizations in organic crystals" (contributed talk).
4. RMC Conference, Denver, CO, August 2003, "Investigation of Cinnamic Acid as a Powder and Single Crystal: H-1 and C-13 Spectra and Simulations" (poster).
3. PCSI Conference, Salt Lake City, UT, January 2003, "Laser-enhanced NMR: New Tools for the Study of Semiconductor Interfaces" (poster).
2. GRC, Solid-State Chemistry, New London, NH, July 2002, "Laser-enhanced NMR: New Tools for the Study of Semiconductors" (poster).
1. ENC Conference, Asilomar, CA, April 2002, "Advancements in optically detected NMR applied to nanoscopic heterostructures" and "Interaction between electric field gradients and the nuclear spin system observed by optically detected NMR in GaAs quantum wells" (posters).

Collaborators

Dr. Marko Bertmer, University of Leipzig, Germany, characterizing the thermal stability of some of the optical switch compounds by solid-state NMR.

Dr. Scott Crooker, Nat'l High Magnetic Field Laboratory, Los Alamos: magneto-optical measurements

Prof. Len MacGillivray, Department of Chemistry, University of Iowa: characterizing supramolecular organic complexes that exhibit photodimerization under photo-irradiation.

Prof. Nigam Rath (UMStL) on x-ray diffraction characterization of our single crystal species.

Prof. Greg Salamo, Department of Physics, University of Arkansas: MBE growth of semiconductor heterostructures

Prof. Chris Stanton, Department of Physics, University of Florida: theoretical modeling of semiconductor bandstructure, especially in the presence of magnetic fields

On campus collaborations with: Profs. Bill Buhro and Rich Loomis (Chemistry) for optical and NMR studies of semiconducting nanowires. Prof. Viktor Gruev (Engineering) for new semiconductor device architectures.

Industrial Collaborators:

Kopin Corporation, characterizing interfaces in heterojunction bipolar transistors

MEMC, characterizing defect sites in silicon

Chemistry Departmental Committees and Service

Chemistry External Chair Search Committee (2009-present)

Chemistry Website (2008-present)

Graduate Work Committee (2003-2004, 2007-2009)

Graduate Program – Minority Recruiting (2007-present)

Inorganic Chemistry Faculty Search Committee (2007)

Awards Committee (2004-present)

Graduate Admissions and Recruiting (2002-present)

Marcus Lecture Committee, Faculty Advisor (2005-present)

Physical Chemistry Faculty Search Committee (2004)

NMR Committee (2001-present)

Thesis Committees: Chemistry Department: 19 students, 4 currently

Undergraduate Advising: 16 students, 6 currently

Washington University Service

Co-chair and creator of the “Washington U. Frontiers in Technology & Science” conference (2009).

Founder and Executive Board member of the Washington U. Family Network. social network and on-line resource.

“Junior Jumpstart” faculty speaker (2009)

Olin Fellows Selection Committee (2009)

Freshman Reading Program, Faculty Discussion Leader (2009)

Israelow Selection Committee (2007)

Physical Sciences Pre-Orientation (2007-2009)

Panelist, Alumni Parents & Admission Program (APAP), 2004-2005

External Thesis Committees:— Physics Department--15 students, 1 currently;
Engineering—3 students;

University of Dortmund, Dept. of Physics, Germany--1 student

Professional Activities and Service

Co-Chair, St. Louis NMR Discussion Group (2004-present)

Chair-elect, Gordon Research Conference, Magnetic Resonance (2013), Vice-chair (2011)

Host, Chicago Area NMR meeting (2008)

Session Chair, Gordon Research Conference, Inorganic Chemistry, (2007)

Organizing Committee, MRS Fall Meeting--Magnetic Resonance in Materials Science (2006)

Humboldt Foundation delegation member to the German Embassy (2006)

Outreach presentation at the St. Louis Science Center, “Nanoscience . . . Just What Is It?” (2006)

Session Chair, PCSI Conference (2005)

Presentation “What’s Next? Contemplating Life after College” at Pew Midstates Science & Math Undergraduate Research Symposium (2004)

Outreach presentation “Materials Science Saturday” for grades 6-12 teachers (2004)

Promotion Reviewer for Physics/Materials faculty member (2004)

Research Sponsor, STARS Summer Research Program (Adam Brandt 2009, Spencer Wells 2008), NSF Summer Research Program in Solid-State Chemistry (Kimberly Hartstein 2009, Alexander Barnes 2003), and the Collaborative for Applied Experiences in Science Program (Ted Carnahan 2003)

Ongoing: Reviewer for *Physical Review B*, *Physical Review Letters*, *Journal of the American Chemical Society*, *Chemistry of Materials*, *Inorganic Chemistry*, *Journal of Solid State Chemistry*, *Journal of Magnetic Resonance*, *Journal of Physics & Chemistry of Solids*, *Concepts in Magnetic Resonance*, *Solid-state Nuclear Magnetic Resonance*, and *Proceedings of the Materials Research Society*

Proposal reviewer for NSF, Army Research Office, and U.S. Civilian R&D Foundation

Professional Memberships

American Chemical Society, Divisions of Inorganic Chemistry and Physical Chemistry

American Physical Society, Division of Materials Physics

Teaching Experience

Chemistry 111, General Chemistry

Chemistry 461, Inorganic Chemistry

Chemistry 541, Advanced Physical Inorganic Chemistry

Physics 534 (Chemistry 576), Magnetic Resonance

Research Associates (current group members are shown in **bold**)

Postdoctoral Associates:

Marko Bertmer: Aug. 2002-Sept. 2003, Feodor Lynen Fellow. He is currently a lecturer (Privatdozent) at University of Leipzig in Experimental Physics. Ph.D. Physical Chemistry, WWU-Münster, Germany, advisor: Prof. Hellmut Eckert. Habilitation, RWTH Aachen, advisor: Prof. Bernhard Blümich.

Julie Herberg: June 2002 - Jan. 2003. She is a Staff Physicist at LLNL, Livermore, CA. Ph.D. Physics, Washington Univ., advisor: Prof. Richard Norberg.

Guibin Ma: Aug. 2003-Aug. 2005. He is currently at the University of Edmonton as a postdoctoral researcher. Ph.D. Chemistry, KTH, Stockholm, Sweden, advisor: Prof. Julius Glaser.

Kannan Ramaswamy: May 2003 - Nov. 2008. He is an Assistant Professor of Physics at BITS-Pilani in Hyderabad, India. Ph.D. Physics, Indian Inst. of Science, Bangalore, advisor: Prof. J. Ramakrishna. Postdoctoral Researcher at the Weizmann Inst. Rehovot, Israel with Prof. Zeev Luz.

Ph.D. Students:

Sarah Gresham (January 2007 – present) Sarah was honored with a 2009 Chemistry Departmental Teaching Award.

Stacy Mui (January 2005 – Oct. 2008) Stacy is a Senior Member of the Technical Staff at Sandia Nat'l Labs, Livermore, CA, as a systems analyst (radiation and nuclear sector). *Honors:* 2008 Finalist, APS Congressional Fellow; 2008 Finalist, Emerging Leaders Program (US Dept. of Health and Human Services); 2007 Travel Award, PCSI Conference; 2007 Dean's Award for Teaching Excellence; 2006 Young Scientist Award, PCSI Conference; 2006 NSF Graduate Fellowship, Honorable Mention; 2006 Chemistry Department Teaching Award.

Ryan Nieuwendaal (January 2003 – March 2008) Ryan is now a National Research Council Postdoctoral Fellow at NIST, Maryland. *Honors:* 2008 Chemistry Departmental Teaching Award; 2006 August and Ruth Homeyer Scholarship; 2006 Dean's Dissertation Fellowship; and 2006 Lindau Nobel Laureate Conference Delegate. Travel award, NSF "Multidimensional High Field Solid-State NMR," University of Illinois, Urbana-Champaign (2005), and ACS-PRF "Physical Chemistry on the Nanometer Scale" Washington State University, Pullman (2003).

Erika Sesti (January 2009 – present)

Katie Wentz (January 2009 – present)

Dustin Wheeler (January 2009 – present)

M.A. Students:

Jhashanath "Subin" Adhikari, M.Sc. Physical Chemistry, Tribhuvan University, Kathmandu, Nepal. Attending Clark University, MA, for a Ph.D. in Chemistry.

P. Curtis Carey, B.A. Chemistry, University of Wyoming. Present position unknown.

Kim Nguyen, B.S. Chemistry, University of Missouri St. Louis. Currently with Prof. Carolyn Anderson at WU Med School for graduate research.

Undergraduate Students:

Kimberly Hartstein: current student, expected A.B. Chemistry in 2012. Honors: selected for NSF Summer Research Program in Solid-State Chemistry, 2009.

Michal Hyrc: current student, expected A.B. Chemical Engineering in 2013. Honors: selected for a WU Undergraduate Research Fellowship, 2009.

Adam Johnson: graduated 2009. Present position unknown.

- Jason Shields:** current student, expected A.B. Chemistry in 2010. Honors: "Outstanding Junior Award" from ACS, Moog Scholar, nominee for the Goldwater Fellowship.
- Dan Daranciang: attending graduate school for physical chemistry at Stanford. (*Honors:* 2006 HyperCube Scholar Award).
- Vinay Kampalath: working for the Boston Urban Asthma Coalition, in a public health role (*Honors:* 2007 Merck Chemistry Award).
- Julia Collins: attending graduate school for chemistry, emphasis on chemical education, at Texas A&M. (*Honors:* HyperCube Award)
- Katie Cychosz: attending graduate school for chemistry at University of Michigan (*Honors:* 2005 Sowden Prize; 2004 Pfizer Summer Undergraduate Research Fellowship).
- Tammy Shirley: currently with TeachForAmerica and will attend WU Medical School, thereafter.
- Chris McArdle: graduated 2005. Present position unknown.
- Ted Carnahan: working in an MIS (computer) role in Columbia, MO.
- Evan Stampler: attending graduate school for inorganic chemistry at Northwestern University.
- Alexander Barnes: attending graduate school for physical chemistry at M.I.T. (*Honors:* 2006 NSF Graduate Fellowship; Phi Beta Kappa; 2003 NSF Summer Research Program in Solid-State Chemistry).

High School Students:

- Spencer Wells: (summer 2008) STARS participant. National Merit Finalist. Attending Univ. of IL, Urbana Champaign as an Engineering major.
- Adam Brandt: (summer 2009) STARS participant.