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Education

2001	Ph.D.	Chemistry	University of California, Berkeley, CA
1993	B.S.	Chemistry	The Evergreen State College, Olympia, WA

Professional Experience

Associate Laboratory Director	Linac Coherent Light Source	2025-present
Interim Associate Laboratory Director	Energy Sciences Directorate	2023-2025
Chemical Sciences Division Director	Energy Sciences Directorate	2019-2023
Deputy Associate Laboratory Director	Energy Sciences Directorate	2019-2023
Associate Laboratory Director	Stanford Synchrotron Radiation Lightsource	2014-2019
Professor	Photon Science, SLAC, Stanford University	2023-present
Professor (courtesy)	Chemistry, Stanford University	2021-present
Associate Professor	Photon Science, SLAC, Stanford University	2013-2023
Assistant Professor	Photon Science, SLAC, Stanford University	2004-2013
Postdoctoral Research Associate	Stanford Synchrotron Radiation Lightsource	2003-2004
Postdoctoral Research Associate	Stanford University	2001-2003
Analytical Chemist	BOC Gases	1993-1995

Research Focus

I lead a research team making stroboscopic movies of condensed phase chemical transformations with atomic specificity and resolution. We use femtosecond optical and x-ray lasers to measure the ultrafast dynamics of electronic and vibrational degrees of freedom in a wide range of systems. Our current research emphasizes experimental assessments of novel design concepts for light-driven chemical transformations in transition metal complexes. This research targets the detailed characterization of electronic excited state trajectories as a key metric for understanding how variations in electronic ground state properties influence electronic excited states. In these studies we also utilize ultrafast optical spectroscopy and steady state x-ray spectroscopy and x-ray scattering.

Leadership and Recognition

- Fellow, Optica, 2026
- Fellow, Royal Society of Chemistry, 2025
- Fellow, American Physical Society, 2024
- Participant, Department of Energy – Office of Science, Basic Research Needs in Laser Technology, 2023
- Chair, Photon Science Department, SLAC, Stanford University 2020-2023
- Member, Advanced Photon Source Scientific Advisory Committee, 2020-2022
- Participant, Committee of Visitors, Department of Energy - Basic Energy Sciences Chemical Sciences, Geosciences and Biosciences Division, 2020
- Member on the Department of Energy - Basic Energy Sciences Council for Chemical Sciences, Geosciences and Biosciences, 2018-2024
- Participant, Department of Energy - Basic Energy Sciences Roundtable on Opportunities for Basic Research at the Frontiers of XFEL Ultrafast Science, 2017
- Participant, Committee of Visitors, Department of Energy - Basic Energy Sciences Chemical Sciences, Geosciences and Biosciences Division, 2017

- Established chemical dynamics research at the SLAC National Accelerator Laboratory facilitated by a grant from the W.M. Keck foundation.
- Led the LCLS ultrafast dynamics x-ray pump-probe (XPP) end-station advisory group.

Invited Talks

1. **Solvation Dynamics at Interfaces and in Hydrogen Bonded Liquids**
   Lawrence Livermore National Lab — Chemical and Materials Science Division — Summer 2002
2. **Dynamics of Photoinjected Electrons at Model Molecular Electronic Interfaces**
   Hewlett-Packard Lab — Quantum Science Research Division — May 9th 2003
3. **Time Resolving the Motions of Molecules at Surfaces and in Liquids**
   SLAC — Stanford Synchrotron Radiation Lab — Jun 5th 2003
4. **Imaging Chemical Dynamics with Ultrafast X-rays**
   Stanford Linear Accelerator Center — SSRL 31st User's Meeting — Oct 21st 2004
5. **Ultrafast X-ray Studies of Structural Dynamics**
   American Crystallography Association National Meeting — Jun 24th 2005
6. **Ultrafast X-ray Studies of Structural Dynamic at SLAC**
   SPIE Conference — Optics and Photonics National Meeting — Aug 3rd 2005
7. **Femtosecond X-ray Measurements of Structural Dynamics**
   Gordon Research Conference — X-ray Physics — Aug 9th 2005
8. **Ultrafast X-ray Measurements of Structural Dynamics: technical challenges at the LCLS**
   XX Congress of the International Union of Crystallography — Aug 24th 2005
9. **Femtosecond X-ray Measurements of Structural Dynamics at the SPPS**
   ALS Users Meeting — Oct 22nd 2005
10. **Femtosecond X-ray Diffraction Studies of Laser Driven Melting at SLAC**
    SPIE Conference — High Power Laser Ablation 2006 — May 9th 2006
11. **Free electron laser studies of structural dynamics**
    Ultrafast Dynamics on Surfaces and in Liquids Workshop at SSRL — Oct 11th 2006
12. **Ultrafast Diffuse Scattering Studies of Melting**
    SSRL User's Meeting — Oct 13th 2006
13. **Making Molecular Movies: ten trillion frames per second**
    SLAC Public Lecture — Dec 12th 2006
14. **Pump Probe Chemical Dynamics**
    Ultrafast X-ray Summer School at SLAC — Jun 20th 2007
15. **Research Opportunities at the X-ray Pump Probe Endstation at the LCLS**
    SSRL User's Meeting — Oct 2nd 2007
16. **Ultrafast x-ray scattering studies of structural dynamics**
    American Chemical Society National Meeting — Apr 7th 2008
17. **Experimental and theoretical studies of carrier dependent lattice stability in semiconductors**
    SPIE Conference — High Power Laser Ablation 2008 — Apr 21th 2008
18. **Making Molecular Movies**
    Low Energy Electrodynamics in Solids 2008 — Jul 3rd 2008
19. **X-ray Free Electron Laser Science**
    Stanford-Berkeley Synchrotron Summer School — Aug 21th 2008
20. **Dynamics of Hydrogen Bond Exchange in Aqueous Electrolyte Solution**
    DOE Condensed Phase and Interfacial Molecular Science Meeting — Oct 21th 2008
21. **Dynamics of Hydrogen Bond Exchange in Aqueous Electrolyte Solution**
    Argonne National Laboratory Chemistry Division Colloquium — Nov 11th 2008
22. **Science Opportunities and Challenges at the X-ray Pump-Probe Endstation at the LCLS**
    JSSRR National Meeting — University of Tokyo — Jan 11th 2009
23. **Science Opportunities and Challenges at the X-ray Pump-Probe Endstation at the LCLS**
    XFEL Colloquium at SPring-8 — Jan 13th 2009
24. **Dynamics of Hydrogen Bond Exchange in Aqueous Electrolyte Solution**
    Western Spectroscopy Association Meeting — Jan 29th 2009
25. **Ionizing Radiation Induced Chemical Dynamics Studied with Ultrafast X-ray Lasers**

Radiation Chemistry in the 21st Century Jul 13th 2009

26. **Ionizing Radiation Induced Chemical Dynamics Studied with Ultrafast X-ray Lasers**
6th International Workshop on X-ray Radiation Damage Mar 12th 2010

27. **Non-equilibrium dynamics studied with femtosecond resolution X-ray scattering**
PHONONS 2010 National Taiwan University Apr 22nd 2010

28. **Complex Molecules in Condensed Phases**
Gordon Research Conference Atomic and Molecular Interactions Jul 22nd 2010

29. **H-bond Switching and Ligand Exchange Dynamics in Aqueous Ionic Solution**
CECAM Vibrational Spectroscopy of Complex Systems May 23rd 2011

30. **H-bond Switching and Ligand Exchange Dynamics in Aqueous Ionic Solution**
Time Resolved Vibrational Spectroscopy XV Jun 23rd 2011

31. **How Does Water Solvate Ions?**
Gordon Research Conference Atomic Physics Jun 28th 2011

32. **Caught in the Act: X-ray spectroscopy studies of reaction mechanisms**
ALS Users Meeting Oct 5th 2011

33. **Caught in the Act: X-ray spectroscopy studies of reaction mechanisms**
SSRL/LCLS Users Meeting Oct 22nd 2011

34. **Resolving the Mechanism of H-bond Switching and Ligand Exchange in Aqueous Ionic Solution**
University of Southern California Department of Chemistry Colloquium Nov 7th 2011

35. **Resolving the Mechanism of H-bond Switching and Ligand Exchange in Aqueous Ionic Solution**
University of California at Irvine Department of Chemistry Colloquium Nov 8th 2011

36. **Resolving the Mechanism of H-bond Switching and Ligand Exchange in Aqueous Ionic Solution**
University of Pennsylvania Department of Chemistry Colloquium Jan 19th 2012

37. **Resolving the Mechanism of H-bond Switching and Ligand Exchange in Aqueous Ionic Solution**
Colorado State University Department of Chemistry Colloquium Feb 2nd 2012

38. **Resolving the Mechanism of H-bond Switching and Ligand Exchange in Aqueous Ionic Solution**
University of Colorado Department of Chemistry Colloquium Feb 3rd 2012

39. **Ultrafast X-ray laser Studies of Coupled Electronic and Nuclear Relaxation Dynamics**
Banff Meeting on Structural Dynamics Feb 21st 2012

40. **Ultrafast X-ray laser Studies of Coupled Electronic and Nuclear Relaxation Dynamics**
American Physical Society March Meeting Feb 27th 2012

41. **Resolving the Mechanism of H-bond Switching and Ligand Exchange in Aqueous Ionic Solution**
MIT Department of Chemistry Colloquium Apr 10th 2012

42. **Ultrafast X-ray laser Studies of Coupled Electronic and Nuclear Relaxation Dynamics**
Argonne Chemical Sciences Colloquium Apr 16th 2012

43. **Resolving the Mechanism of H-bond Switching and Ligand Exchange in Aqueous Ionic Solution**
University of Chicago Department of Chemistry Colloquium Apr 17th 2012

44. **Resolving the Mechanism of H-bond Switching and Ligand Exchange in Aqueous Ionic Solution**
University of Illinois at Champaign-Urbana Department of Chemistry Colloquium Apr 18th 2012

45. **Resolving the Mechanism of H-bond Switching and Ligand Exchange in Aqueous Ionic Solution**
University of Wisconsin at Madison Department of Chemistry Colloquium Apr 20th 2012

46. **Ultrafast X-ray laser Studies of Coupled Electronic and Nuclear Relaxation Dynamics**
Helmholtz Center Berlin Colloquium May 8th 2012

47. **Ultrafast X-ray laser Studies of Coupled Electronic and Nuclear Relaxation Dynamics**
Center for Free Electron Lasers May 9th 2012

48. **Vibrational Anisotropy Studies of Chemical Dynamics**
Max Born Institute Berlin May 11th 2012

49. **Resolving the Mechanism of H-bond Switching and Ligand Exchange in Aqueous Ionic Solution**
University of California at San Diego Department of Chemistry Colloquium May 22nd 2012

50. **Ion Recognition and Assembly: Mechanistic studies of ligand exchange in aqueous solution**
Telluride Science Research Center Jul 3rd 2012

51. **Tracking Non-Adiabatic Electron Transfer Dynamics with X-ray Spectroscopy**
Gordon Research Conference Electron Donor-Acceptor Interactions Aug 8th 2012

52. **Ultrafast X-ray Laser Studies of Coupled Electronic and Nuclear Dynamics**
Ginzton-PULSE Seminar Aug 30th 2012

53. **Caught in the Act: Using stroboscopic measurements to study chemical dynamics**

SLAC Colloquium — Jan 28th 2013

54. **Ultrafast X-ray Laser Studies of Coupled Electronic and Nuclear Relaxation Dynamics**
SLAC Photon Science Seminar — Mar 20th 2013

55. **Ligand and Solvent Manipulation of Excited State Spin Dynamics in Iron Complexes**
ACS National Meeting, New Orleans — Apr 9th 2013

56. **Ultrafast X-ray Laser Studies of Coupled Electronic and Nuclear Relaxation Dynamics**
University of Kansas Chemistry Department Colloquium — Apr 19th 2013

57. **Time-Resolved X-ray Applications in Chemistry**
Ultrafast X-ray Summer School — Jun 13th 2013

58. **Ultrafast X-ray laser Studies of Chemical Dynamics**
Helmholtz Center Berlin Colloquium — June 25th 2013

59. **Caught in the Act: Time Resolved Investigations of Chemical Dynamics**
XFEL School and Symposium Dinard, France — Sep 17th 2013

60. **Tracking Charge and Spin Dynamics in Iron Complexes with K-edge Fluorescence Spectroscopy**
Dynamic Pathways in Multidimensional Landscapes Berlin, Germany — Sept 19th 2013

61. **Tracking Excited State Charge and Spin Dynamics in Iron Complexes**
University of Nevada-Reno Chemistry Department Colloquium — Apr 11th 2014

62. **Ion Recognition and Assembly Dynamics in Aqueous Solution**
Telluride Science Research Center — Jul 8th 2014

63. **Can we control electronic excited states in 3d coordination chemistry with ligand engineering?**
Ultrafast Experiments at XFEL Sources Sørup Herregård, Denmark — Aug 25th 2014

64. **Investigating Chemical Reaction Dynamics with Time Resolved X-ray Tools**
Pico to Femto Helmholtz Zentrum Berlin — Jan 26th 2015

65. **Tracking the charge and spin dynamics of electronic excited states in inorganic complexes**
American Physical Society San Antonio, TX — Mar 2nd 2015

66. **Site Specific Solvation Dynamics in Inorganic Chemistry**
3rd International Conference on Structural Dynamics Zurich, Switzerland — Jun 10th 2015

67. **Probing Chemical Reaction Dynamics with Atomic Resolution and Specificity**
XAFS16 Karlsruhe, Germany — Aug 25th 2015

68. **Site Specific Solvation Dynamics of a Model Photocatalyst Studied with Ultrafast X-ray Scattering**
Pacificem Honolulu, HI — Dec 15th 2015

69. **Making Molecular Movies: A New Era in X-ray Science**
Board on Chemical Science & Technology, National Academy of Science Irvine CA — Aug 4th 2016

70. **Triangulating Intersections Between Electronic States with Ultrafast X-ray Scattering & Spectroscopy**
International Conference on Dynamic Pathways, Berlin, Germany — Sept 13th 2016

71. **Femtosecond X-ray Laser Studies of Electron Transfer Dynamics in 3d Transition Metal Complexes**
MIT School of Engineering — Dec 7th 2016

72. **Triangulating Intersections Between Electronic States with Ultrafast X-ray Scattering & Spectroscopy**
Banff 5th Meeting on Structural Dynamics — Feb 19th 2017

73. **Addressing Persistent Challenges with Novel Tools: Ultrafast x-ray scattering probes of solvation dynamics**
ACS National Meeting San Francisco — Apr 2nd 2017

74. **Ultrafast X-ray Laser Studies of Electronic Excited States in 3*d* Metal Complexes**
ISPPCC Oxford, England — Jul 10th 2017

75. **Finding Intersections Between Excited States with Ultrafast X-ray Scattering and Spectroscopy**
Fontiers in Optics and Laser Science Washington D.C. — Sep18th 2017

76. **Measuring Photo-Catalytic Reactions with Atomic Specificity and Chemical Accuracy**
Exascale Computing for Materials Genome Initiative Spetses Greece — Jun 12th 2018

77. **Towards Control of Internal Conversion and Intersystem Crossoing in Iron Complexes**
Time Resolved Chemistry Workshop, Argonne National Laboratory, IL — Oct 1st 2019

78. **Towards Control of 3d Transition Metal Complex Excited State Dynamics**
Caltech Chemistry Seminar Pasadena, CA — Dec 9th 2019

79. **Developing the *ChemRIXS* Station: Chemical dynamics research at 120Hz**
SSRL-LCLS Users Meeting — Sep 29th 2020

80. **Imaging Chemical Transformations with X-ray Lasers**
University of Illinois at Champagne-Urbana Chemistry Seminar — Dec 2nd 2020

81. **Imaging Chemical Transformations with X-ray Lasers**

Imperial College, London Ultrafast Network Seminar — Dec 8th 2021

82. **Accessing the Fluctuation Dynamics of Solutions with Ångström and Femtosecond Resolution**
Pacifichem 2021 International Chemical Congress — Dec 16th 2021

83. **Towards Control of Internal Conversion & Intersystem Crossing in Iron Coordination Complexes**
Pacifichem 2021 International Chemical Congress — Dec 17th 2021

84. **Identifying Design Principles for Influencing Electronic Excited States of Metal Complexes**
ACS National Meeting San Diego — Mar 24th 2022

85. **Identifying Design Principles for Influencing Electronic Excited States of Metal Complexes**
Light-Controlled Reactivity in Metal Complexes, Jena, Germany — May 12th 2022

86. **Capturing Chemical Dynamics with Atomic Specificity and Resolution**
International Symposium on Molecular Spectroscopy, University of Illinois — Jun 20th 2023

87. **Capturing Photo-Driven Chemistry with Atomic Resolution and Specificity**
Photochemistry Gordon Conference, Lewiston, Maine — Jul 30th 2023

88. **Imaging Chemical Transformations with X-ray Lasers**
University of Arizona Department of Chemistry Colloquium — Feb 1st 2024

89. **Imaging Chemical Transformations with X-ray Lasers**
Purdue University Department of Chemistry Colloquium — Feb 28th 2024

90. **Capturing chemical dynamics with atomic specificity and resolution**
International Conference on Coordination Chemistry, Fort Collins CO — Aug 1st 2024

91. **Capturing chemical dynamics with atomic specificity and resolution**
Florida State University Department of Chemistry Colloquium — Sep 6th 2024

92. **Time-Resolved Chemical Applications of Soft X-ray RIXS**
Ringberg XFEL Workshop — Feb 4th 2025

93. **Time-Resolved Chemical Applications of Soft X-ray RIXS**
Light controlled reactivity of metal complexes Johannes Gutenberg University Mainz, Ger — Apr 1st 2025

Peer Reviewed Journal Articles

1. Femtosecond Dynamics of Electron Localization at Interfaces: N.-H. Ge, C.M. Wong, R.L. Lingle, Jr., J.D. McNeill, K.J. Gaffney, C.B. Harris, *Science* **279**, 202 (1998). ***see also*** – Self-Trapping of Electrons at Surfaces: U. Hofer *Science* **279**, 190 (1998).
2. Femtosecond Studies of Electron Dynamics at Dielectric-Metal Interfaces: C.M. Wong, J.D. McNeill, K.J. Gaffney, N.-H. Ge, A.D. Miller, S.H. Liu, C.B. Harris, **feature article** *J. Phys. Chem. B* **103**, 282 (1999).
3. Femtosecond Electron Dynamics at the Benzene/Ag(111) Interface: K.J. Gaffney, C.M. Wong, S.H. Liu, A.D. Miller, J.D. McNeill, C.B. Harris, *Chem. Phys.* **251**, 99 (2000).
4. The Adsorbate Electron Affinity Dependence of Femtosecond Electron Dynamics at Dielectric/Metal Interfaces: K.J. Gaffney, S.H. Liu, A.D. Miller, P. Szymanski, C.B. Harris*, J. Chin. Chem. Soc*. **47**, 759 (2000).
5. Femtosecond Dynamics of Electrons Photoinjected into Organic Semiconductors at Aromatic Metal Interfaces: K.J. Gaffney, A.D. Miller, S.H. Liu, C.B. Harris, **feature article** *J. Phys. Chem. B* **105**, 9031 (2001).
6. Evolution of a Two Dimensional Band Structure at a Self-Assembling Interface: A.D. Miller, K.J. Gaffney, S.H. Liu, P. Szymanski, S. Garrett-Roe, C.B. Harris, *J. Phys. Chem.* A **106**, 7636 (2002).
7. Electron Solvation in Two Dimensions: A.D. Miller, I. Bezel, K.J. Gaffney, S. Garrett-Roe, S.H. Liu, P. Szymanski, C.B. Harris, *Science* **297**, 1163 (2002).
8. Hydrogen Bond Breaking and Reformation in Alcohol Oligomers Following Vibrational Relaxation of a Non-hydrogen Bond Donating Hydroxyl Stretch: K.J. Gaffney, I.R. Piletic, M.D. Fayer, *J. Phys. Chem. A* **106**, 9428 (2002).
9. Direct Observation of Two Dimensional Electron Solvation By Alcohol/Ag(111) Interfaces: S.H. Liu, A.D. Miller, K.J. Gaffney, P. Szymanski, S. Garrett-Roe, I. Bezel, C.B. Harris, *J. Phys. Chem*. *B* **106**, 12908 (2002).
10. Hydrogen Bond Dissociation and Reformation in Methanol Oligomers Following Hydroxyl Stretch Relaxation: K.J. Gaffney, P.H. Davis, N.E. Levinger, I.R. Piletic, M.D. Fayer, *J. Phys. Chem. A* **106**, 12012 (2002).
11. Orientational Relaxation and Vibrational Excitation Transfer in Methanol – Carbon Tetrachloride Solutions: K.J. Gaffney, I.R. Piletic, M.D. Fayer, *J. Chem. Phys.* **118**, 2270 (2003).
12. Structural Dynamics of Hydrogen Bonded Methanol Oligomers: Vibrational Transient Hole Burning Studies of Spectral Diffusion: I.R. Piletic, K.J. Gaffney, M.D. Fayer, *J. Chem. Phys.* **119**, 423 (2003).
13. Ultrafast Heterodyne Detected Infrared Multidimensional Vibrational Stimulated Echo Studies of Hydrogen Bond Dynamics: J.B. Asbury, T. Steinel, C. Stromberg, K. J. Gaffney, I. R. Piletic, A. Goun, M. D. Fayer, *Chem. Phys. Lett.* **374**, 362 (2003).

14. Hydrogen Bond Dynamics Probed with Ultrafast Infrared Heterodyne Detected Multidimensional Vibrational Stimulated Echoes: J.B. Asbury, T. Steinel, C. Stromberg, K. J. Gaffney, I. R. Piletic, A. Goun, M. D. Fayer, *Phys. Rev. Lett.* **91**, 237402 (2003).
15. Hydrogen Bond Breaking Probed with Multidimensional Stimulated Vibrational Echo Correlation Spectroscopy: J.B. Asbury, T. Steinel, C. Stromberg, K.J. Gaffney, I.R. Piletic, M.D. Fayer, *J. Chem. Phys.* **119**, 12981 (2003).
16. Measurement and Dynamics of the Spatial Distribution of an Electron Localized at a Metal-Dielectric Interface: I. Bezel, K.J. Gaffney, S. Garrett-Roe, S.H. Liu, A.D. Miller, P. Szymanski, C.B. Harris, *J. Chem. Phys.* **120**, 845 (2004).
17. Clocking Femtosecond X-rays: A.L. Cavalieri *et al.*, *Phys. Rev. Lett.* **94**, 114801 (2005).
18. Atomic Scale Visualization of Inertial Dynamics: A.M. Lindenberg *et al.*, *Science* **308**, 392 (2005).
19. Observation of Structural Anisotropy and the Onset of Liquid-like Motion During the Nonthermal melting of InSb: K.J. Gaffney, *et al.*, *Phys. Rev. Lett.* **95**, 125701 (2005).
20. Ultrafast Dynamics of Laser-Excited Solids: D.A. Reis, K.J. Gaffney, G.H. Gilmer, D. Torralva, *Mat. Res. Soc. Bull.* **31**, 601 (2006).
21. Ultrafast Bond Softening in Bismuth: Mapping a Solid's Interatomic Potential with X-rays: D.M. Fritz, *et al. Science* **315**, 633 (2007). ***see also –*** Watching Atoms Move: J.D. Brock *Science* 315**,** 609 (2007).
22. Carrier Density Dependent Lattice Stability in InSb: P.B. Hillyard, *et al. Phys. Rev. Lett.* **98**, 125501 (2007)**.**
23. Imaging Atomic Structure and Dynamics with Ultrafast X-ray Scattering: K.J. Gaffney, H.N. Chapman, *Science* **316**, 1444 (2007).
24. X-ray Diffuse Scattering Measurements of Nucleation Dynamics at Femtosecond Resolution: A.M. Lindenberg, *et al. Phys. Rev. Lett.* **100**, 135502 (2008).
25. Ultrafast Carrier Induced Disordering in InSb Studied with Density Functional Perturbation Theory: P.H. Hillyard, D.A. Reis, K.J. Gaffney, *Phys. Rev. B* **77**, 195213 (2008).
26. Efficient Multiple Exciton Generation Observed in Colloidal PbSe Quantum Dots with Temporally and Spectrally Resolved Intraband Excitation: M. Ji, S. Park, S.T. Connor, T. Mokari, Y. Cui, K.J. Gaffney, *Nano. Lett.* **9**, 1217 (2009).
27. Ultrafast Dynamics of Hydrogen Bond Exchange in Aqueous Ionic Solutions: S. Park, M. Odelius, K.J. Gaffney, *J. Phys. Chem. B* **113**, 7825 (2009).
28. Atomic Resolution Mapping of the Excited State Electronic Structure of Cu_2O with Time-Resolved X-Ray Absorption Spectroscopy: P.B. Hillyard, *et al.*, *Phys. Rev. B* **80**, 125210 (2009).
29. Characterization of Charge Transfer Excitations in Hexacyanomanganate(III) with Mn K-Edge Resonant Inelastic X-ray Scattering, D.A. Meyer, U. Bergmann, X. Zhang, K.J. Gaffney, *J. Chem. Phys.* **132**, 134502 (2010).
30. Ligand Exchange Dynamics in Aqueous Solution Studied with 2DIR Spectroscopy: S. Park, M. Ji, K.J. Gaffney, *J. Phys. Chem. B* **114**, 6693 (2010).
31. Large Angular Jump Mechanism Observed for Hydrogen Bond Exchange in Aqueous Perchlorate Solution: M. Ji, M. Odelius, K.J. Gaffney, *Science* **328**, 1003 (2010). ***see also –*** Following the Motions of Water Molecules in Aqueous Solutions: J.L. Skinner *Science* **328**, 985 (2010).
32. Dynamics of Ion Assembly in Solution: 2DIR Spectroscopy Study of LiNCS in Benzonitrile: M. Ji, S. Park, K.J. Gaffney, *J. Phys. Chem. Lett.* **1**, 1771 (2010).
33. Orientational Relaxation Dynamics in Aqueous Ionic Solution: Polarization-Selective Two-Dimensional Infrared Study of Angular Jump-Exchange Dynamics in Aqueous 6M $NaClO_4$: M. Ji, K.J. Gaffney, *J. Chem. Phys.* **134**, 044516 (2011).
34. H-bond Switching and Ligand Exchange Dynamics in Aqueous Ionic Solution: K.J. Gaffney, M. Ji, M. Odelius, S. Park, Z. Sun, **frontiers article** *Chem. Phys. Lett.* **504**, 1 (2011).
35. Characterizing the Deformational Isomers of Bimetallic $Ir_2(dimen)_4^{2+}$ (dimen = 1,8-diisocyano-*p*-menthane) with Vibrational Wavepacket Dynamics: R.W. Hartsock, W. Zhang, M.G. Hill, B. Sabat, K.J. Gaffney, *J. Phys. Chem. A* **115**, 2920 (2011).
36. Interdependence of Conformational and Chemical Reaction Dynamics during Ion Assembly in Polar Solvents: M. Ji, R.W. Hartsock, Z. Sun, K.J. Gaffney, *J. Phys. Chem. B* **115**, 11399 (2011).
37. Direct Measurement of the Protein Response to an Electrostatic Perturbation that Mimics the Catalytic Cycle of Ketosteroid Isomerase: S.K. Jha, M. Ji, K.J. Gaffney, S.G. Boxer, *Proc. Natl. Acad. Sci. USA* **108**, 16612 (2011).
38. Influence of Solute-Solvent Coordination on the Orientational Relaxation of Ion Assemblies in Polar Solvents: M. Ji, R.W. Hartsock, Z. Sun, K.J. Gaffney, *J. Chem. Phys.* **136**, 014501 (2012).
39. Dynamics of Solvent Mediated Electron Localization in Electronically Excited Hexacyanoferrate(III): W. Zhang, M. Ji, Z. Sun, K.J. Gaffney, *J. Amer. Chem. Soc.* **134**, 2581 (2012).
40. Site-Specific Measurement of Water Dynamics in the Substrate Pocket of Ketosteroid Isomerase Using Time-Resolved Vibrational Spectroscopy: S.K. Jha, M. Ji, K.J. Gaffney, S.G. Boxer, *J. Phys. Chem. B* **116**, 11414 (2012).
41. Resolving Photo-Induced Twisted Intramolecular Charge Transfer with Vibrational Anisotropy and TDDFT: W. Zhang, Z. Lan, Z. Sun, K.J. Gaffney, *J. Phys. Chem. B* **116**, 11527 (2012).

42. Resonant Inelastic Soft X-ray Scattering on Liquid Jets at Synchrotron and Free Electron Laser Light Sources: K. Kunnus, *et al. Rev. Sci. Instrum.***83**, 123109 (2012).
43. Femtosecond X-ray Absorption Spectroscopy at a Hard X-ray Free Electron Laser: Application to Spin Crossover Dynamics: H.T. Lemke, *et al. J. Phys. Chem. A* **117**, 735 (2013).
44. Aqueous Mg^{2+} and Ca^{2+} Ligand Exchange Mechanisms Identified with 2DIR Spectroscopy: Z. Sun, W. Zhang, M. Ji, and K.J. Gaffney, *J. Phys. Chem. B* **117**, 12268 (2013).
45. Contact Ion Pair Formation between Hard Acids and Soft Bases in Aqueous Solutions Observed with 2DIR Spectroscopy: Z. Sun, W. Zhang, M. Ji, R.W. Hartsock, K.J. Gaffney *J. Phys. Chem. B* **117**, 15306 (2013).
46. Fourier-transform Inelastic X-ray Scattering from Time- and Momentum-Dependent Phonon–Phonon Correlations: M. Trigo, *et al. Nature Physics* **9**, 790 (2013). ***see also –*** Condensed-matter physics: Picking up fine vibrations: P. Abbamonte *Nature Physics* **9**, 759 (2013).
47. Tracking Excited State Charge and Spin Dynamics in Iron Coordination Complexes: W. Zhang *et al. Nature* **509**, 345 (2014). ***see also*** – X-ray spectroscopy: Enlightened state: J.K. McCusker *Nature Physics* **10**, 476 (2014).
48. Ultrafast X-ray Auger Probing of Photoexcited Molecular Dynamics: B.K. McFarland, *et al. Nature Comm.* **5**, 4235 (2014).
49. Orbital-Specific Mapping of the Ligand Exchange Dynamics of $Fe(CO)_5$ in Solution: P. Wernet *et al. Nature* **520**, 78 (2015).
50. Mechanistic Studies of Photo-Induced Spin Crossover and Electron Transfer in Inorganic Complexes: W. Zhang, K.J. Gaffney *Acc. Chem. Res.* **48**, 1140 (2015).
51. Identification of the dominant photochemical pathways and mechanistic insights to the ultrafast ligand exchange of $Fe(CO)_5$ to $Fe(CO)_4EtOH$: K. Kunnus *et al. Struct. Dyna.* **3**, 043204 (2016).
52. Diffractive Imaging of a Molecular Rotational Wavepacket with Femtosecond Megaelectronvolt Electron Pulses: J. Yang, et al. *Nature Comm.* **7**, 11232 (2016).
53. Femtosecond X-ray Scattering Study of Ultrafast Photoinduced Structural Dynamics in Solvated $[Co(terpy)_2]^{2+}$: E. Biasin, *et al. Phys. Rev. Lett.* **117**, 013002 (2016).
54. Viewing the Valence Electronic Structure of Ferric and Ferrous Hexacyanide in Solution from the Fe and Cyanide Perspectives: K. Kunnus, *et al. J. Phys. Chem. B* **120**, 7182 (2016).
55. Anti-Stokes Resonant X-ray Raman Scattering for atom specific and excited state selective dynamics: K. Kunnus, *et al. New J. Phys.* **18**, 103011 (2016).
56. Atomistic Characterization of the Active-Site Solvation Dynamics of a Model Photocatalyst: T.B. van Driel, *et. al. Nature Comm.* **7**, 13678 (2016).
57. Femtosecond Gas Phase Electron Diffraction with MeV Electrons: J. Yang, *et al. Faraday Discuss.* **194**, 563 (2016).
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