Stanford

Kelly Gaffney

Professor of Photon Science and, by courtesy, of Chemistry

Photon Science Directorate

Resume available Online

Bio

BIO

Professor Gaffney directs the Linac Coherent Light Source (LCLS), an internationally leading research facility open to users from around the world. LCLS, the world's first Ångström wavelength x-ray laser, has driven a revolution in x-ray science. The x-ray pulses produced by LCLS have a peak brightness a billion times greater than those produced by conventional sources, such as a synchrotron. The first generation of LCLS enabled unique science opportunities driven by the ultrashort duration of the intense x-ray pulses generated by LCLS – durations from tens of femtoseconds to hundreds of attoseconds. This has enabled the functional dynamics of biological, chemical, and materials systems to be captured with atomistic resolution without blurring in space or time.

LCLS has now initiated a second revolution in x-ray laser science, by building a superconducting accelerator for x-ray generation, in addition to the normal conducting accelerator used for the first generation of x-ray laser operations. This new accelerator maintains the peak brightness of the normal conducting accelerator, but enables the repetition rate to be increased from 120 Hz to 1 MHz and enables a four-orders of magnitude increase in average brightness. This new source has the potential to transform x-ray imaging and high resolution x-ray spectroscopy.

Professor Gaffney also leads a research team focused on femtosecond resolution measurements of chemical dynamics in complex condensed phase systems. This research takes advantage of recent advances in ultrafast x-ray lasers, like the LCLS, to directly observe chemical reactions on the natural time and length scales of the chemical bond – femtoseconds and Ångströms. This research focuses on the discovery of design principles for controlling the non-equilibrium dynamics of electronic excited states and using these principles to spark new approaches to light-driven catalysis in chemical synthesis.

ACADEMIC APPOINTMENTS

- Professor, Photon Science Directorate
- Professor (By courtesy), Chemistry
- Principal Investigator, Stanford PULSE Institute

ADMINISTRATIVE APPOINTMENTS

- Associate Laboratory Director, Linac Coherent Light Source, SLAC National Accelerator Laboratory, (2025- present)
- Interim Associate Laboratory Director, Energy Sciences Directorate, SLAC National Accelerator Laboratory, (2023-2025)
- Department chair, Photon Science Department, (2020-2023)
- Chemical Sciences Division Director, Energy Sciences Directorate, SLAC National Accelerator Laboratory, (2019-2023)

- Deputy Associate Laboratory Director, Energy Sciences Directorate, SLAC National Accelerator Laboratory, (2019-2023)
- Associate Laboratory Director, Stanford Synchrotron Radiation Lightsource, SLAC National Accelerator Laboratory, (2014-2019)
- Principle Investigator, PULSE Institute, (2007- present)

HONORS AND AWARDS

- Fellow, Optica (2026)
- Fellow, Royal Society of Chemistry (2025)
- Fellow, American Physical Society (2024)

PROFESSIONAL EDUCATION

- PhD, University of California at Berkeley , Chemistry (2001)

LINKS

- publications listed in google scholar: https://scholar.google.com/citations?user=djbqvbAAAAAJ&hl=en

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

My research group makes 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 using 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 state photochemistry and photophysics. In these studies we utilize steady state and time resolved optical and x-ray spectroscopy, as well as x-ray scattering.

Teaching

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Aaron Charnay

Postdoctoral Faculty Sponsor

Yukio Cho, Reagan Hooper, Cheolwoo Park, Weiyu Qian, Yibo Wang

Doctoral Dissertation Advisor (AC)

Shuri Francis, Kacie Nelson

Publications

PUBLICATIONS

- **Highly-destabilized ligand field excited states of iron carbene complexes and their relation to charge transfer state lifetimes.** *Chemical science*
  Hooper, R. X., Poulter, B. I., Schwarz, J., Barakat, M., Kunnus, K., Nelson, K. J., Ilic, A., García-Mateos, C., Chowdhury, R., Uhlig, J., Wärnmark, K., Jakubikova, E., Cordones, et al
  2026
- **Time-Resolved X-ray Emission Spectroscopy and Synthetic High-Spin Model Complexes Resolve Ambiguities in Excited-State Assignments of Transition-Metal Chromophores: A Case Study of Fe-Amido Complexes.** *Journal of the American Chemical Society*

Reinhard, M. E., Sidhu, B. K., Lozada, I. B., Powers-Riggs, N., Ortiz, R. J., Lim, H., Nickel, R., Lierop, J. v., Alonso-Mori, R., Chollet, M., Gee, L. B., Kramer, P. L., Kroll, et al

2024

- **Characterization of Deformational Isomerization Potential and Interconversion Dynamics with Ultrafast X-ray Solution Scattering.** *Journal of the American Chemical Society*

  Powers-Riggs, N. E., Birgisson, B. O., Raj, S. L., Biasin, E., Lenzen, P., Zederkof, D. B., Haubro, M., Tveiten, D. K., Hartsock, R. W., van Driel, T. B., Kunnus, K., Chollet, M., Robinson, et al

  2024

- **Optically Induced Anisotropy in Time-Resolved Scattering: Imaging Molecular-Scale Structure and Dynamics in Disordered Media with Experiment and Theory.** *Physical review letters*

  Montoya-Castillo, A., Chen, M. S., Raj, S. L., Jung, K. A., Kjaer, K. S., Morawietz, T., Gaffney, K. J., van Driel, T. B., Markland, T. E.

  2022; 129 (5): 056001

- **Capturing Atom-Specific Electronic Structural Dynamics of Transition-Metal Complexes with Ultrafast Soft X-Ray Spectroscopy.** *Annual review of physical chemistry*

  Jay, R. M., Kunnus, K., Wernet, P., Gaffney, K. J.

  1800

- **Reduction of Electron Repulsion in Highly Covalent Fe-Amido Complexes Counteracts the Impact of a Weak Ligand Field on Excited-State Ordering.** *Journal of the American Chemical Society*

  Larsen, C. B., Braun, J. D., Lozada, I. B., Kunnus, K., Biasin, E., Kolodziej, C., Burda, C., Cordones, A. A., Gaffney, K. J., Herbert, D. E.

  2021

- **Direct observation of ultrafast hydrogen bond strengthening in liquid water.** *Nature*

  Yang, J., Dettori, R., Nunes, J. P., List, N. H., Biasin, E., Centurion, M., Chen, Z., Cordones, A. A., Deponte, D. P., Heinz, T. F., Kozina, M. E., Ledbetter, K., Lin, et al

  2021; 596 (7873): 531-535

- **Capturing photochemical and photophysical transformations in iron complexes with ultrafast X-ray spectroscopy and scattering** *CHEMICAL SCIENCE*

  Gaffney, K. J.

  2021; 12 (23): 8010-8025

- **Direct observation of coherent femtosecond solvent reorganization coupled to intramolecular electron transfer.** *Nature chemistry*

  Biasin, E., Fox, Z. W., Andersen, A., Ledbetter, K., Kjar, K. S., Alonso-Mori, R., Carlstad, J. M., Chollet, M., Gaynor, J. D., Glownia, J. M., Hong, K., Kroll, T., Lee, et al

  2021

- **Chemical control of competing electron transfer pathways in iron tetracyano-polypyridyl photosensitizers** *CHEMICAL SCIENCE*

  Kunnus, K., Li, L., Titus, C., Lee, S., Reinhard, M. E., Koroidov, S., Kjaer, K. S., Hong, K., Ledbetter, K., Doriese, W. B., O'Neil, G. C., Swetz, D. S., Ullom, et al

  2020; 11 (17): 4360–73

- **Metal-ligand covalency of C-H activating iridium complexes from L-edge valence-to-core resonant inelastic X-ray scattering.** *Chemical science*

  Jay, R. M., Banerjee, A., Reinhard, M., Zhao, H., Huse, N., Gaffney, K. J., Kroll, T., Sokaras, D., Wernet, P.

  2026

- **Ultrafast Population and Structural Dynamics of a Ni-Bipyridine Photoredox Catalyst Reveal a Significant Deactivation Pathway.** *The journal of physical chemistry letters*

  Raj, S. L., Curtolo, F., Nelson, K. J., Cagan, D. A., Hooper, R. X., Bím, D., Follmer, A. H., Ribson, R. D., Kazmierczak, N. P., McNicholas, B. J., Powers-Riggs, N., Sachs, M., Biasin, et al

  2026

- **Nonadiabatic dynamics of photoexcited thiopyridone isomers: An interplay between El-Sayed's conditions and energy gap law.** *The Journal of chemical physics*

  Das, S. K., Garratt, D., Gaffney, K., Odelius, M.

  2025; 163 (23)

- **Influence of substitution pattern on the dynamics of internal conversion and intersystem crossing in thiopyridone isomers.** *Physical chemistry chemical physics : PCCP*
  Garratt, D., Das, S. K., Nelson, K. J., Harich, J., Freibert, A., Bacellar, C., Cirelli, C., Johnson, P. J., Castillo, R. G., Zoric, M. R., Wang, R. P., Lim, H., Cordones, et al
  2025
- **Real-space observation of the dissociation of a transition metal complex and its concurrent energy redistribution.** *Nature communications*
  Schori, A., Biasin, E., Banerjee, A., Boutet, S., Bucksbaum, P. H., Carbajo, S., Gaffney, K. J., Glownia, J. M., Hartsock, R., Ledbetter, K., Kaldun, A., Koglin, J. E., Kunnus, et al
  2025; 16 (1): 4767
- **Structure and ultrafast dynamics of tri-nuclear Ag-/Tl-Pt₂POP₄ complexes in solution** *STRUCTURAL DYNAMICS-US*
  Lenzen, P., Haldrup, K., Dohn, A. O., Beyer, F., Biasin, E., Christensen, M., Hansen, B. L., Harlang, T., Kjaer, K., Laursen, M., Vester, P., van Driel, T. B., Chollet, et al
  2025; 12 (4)
- **Excited State Covalency, Dynamics, and Photochemistry of Square Planar Ni-Thiolate Complexes Revealed by Ultrafast X-ray Absorption.** *Journal of the American Chemical Society*
  Lim, H., Yang, X., Larsen, C. B., Ledbetter, K., Zoric, M. R., Raj, S. L., Kumar, G., Powers-Riggs, N., Hoffmann, M. C., Chollet, M., Gee, L. B., van Driel, T. B., Alonso-Mori, et al
  2025
- **Multiconfigurational Electronic Structure of Nickel Cross-Coupling Catalysts Revealed by X-ray Absorption Spectroscopy.** *The journal of physical chemistry letters*
  Nelson, K. J., Kazmierczak, N. P., Cagan, D. A., Follmer, A. H., Scott, T. R., Raj, S. L., Garratt, D., Powers-Riggs, N., Gaffney, K. J., Hadt, R. G., Cordones, A. A.
  2024: 87-94
- **Observation of a Picosecond Light-Induced Spin Transition in Polymeric Nanorods.** *ACS nano*
  Reinhard, M., Kunnus, K., Ledbetter, K., Biasin, E., Zederkof, D. B., Alonso-Mori, R., van Driel, T. B., Nelson, S., Kozina, M., Borkiewicz, O. J., Lorenc, M., Cammarata, M., Collet, et al
  2024
- **A US perspective on closing the carbon cycle to defossilize difficult-to-electrify segments of our economy.** *Nature reviews. Chemistry*
  Shaw, W. J., Kidder, M. K., Bare, S. R., Delferro, M., Morris, J. R., Toma, F. M., Senanayake, S. D., Autrey, T., Biddinger, E. J., Boettcher, S., Bowden, M. E., Britt, P. F., Brown, et al
  2024
- **Solution phase high repetition rate laser pump x-ray probe picosecond hard x-ray spectroscopy at the Stanford Synchrotron Radiation Lightsource** *STRUCTURAL DYNAMICS-US*
  Reinhard, M., Skoien, D., Spies, J. A., Garcia-Esparza, A. T., Matson, B. D., Corbett, J., Tian, K., Safranek, J., Granados, E., Strader, M., Gaffney, K. J., Alonso-Mori, R., Kroll, et al
  2023; 10 (5): 054304
- **Ferricyanide photo-aquation pathway revealed by combined femtosecond Kβ main line and valence-to-core x-ray emission spectroscopy.** *Nature communications*
  Reinhard, M., Gallo, A., Guo, M., Garcia-Esparza, A. T., Biasin, E., Qureshi, M., Britz, A., Ledbetter, K., Kunnus, K., Weninger, C., van Driel, T., Robinson, J., Glownia, et al
  2023; 14 (1): 2443
- **Dissociation of Pyridinethiolate Ligands during Hydrogen Evolution Reactions of Ni-Based Catalysts: Evidence from X-ray Absorption Spectroscopy.** *Inorganic chemistry*
  Ledbetter, K., Larsen, C. B., Lim, H., Zoric, M. R., Koroidov, S., Pemmaraju, C. D., Gaffney, K. J., Cordones, A. A.
  2022
- **The case for data science in experimental chemistry: examples and recommendations** *NATURE REVIEWS CHEMISTRY*
  Yano, J., Gaffney, K. J., Gregoire, J., Hung, L., Ourmazd, A., Schrier, J., Sethian, J. A., Toma, F. M.
  2022; 6 (5): 357-370
- **Quantifying the Steric Effect on Metal-Ligand Bonding in Fe Carbene Photosensitizers with Fe 2p3d Resonant Inelastic X-ray Scattering.** *Inorganic chemistry*

Kunnus, K., Guo, M., Biasin, E., Larsen, C. B., Titus, C. J., Lee, S. J., Nordlund, D., Cordones, A. A., Uhlig, J., Gaffney, K. J.
1800

- **Short-lived metal-centered excited state initiates iron-methionine photodissociation in ferrous cytochrome c.** *Nature communications*
  Reinhard, M. E., Mara, M. W., Kroll, T., Lim, H., Hadt, R. G., Alonso-Mori, R., Chollet, M., Glownia, J. M., Nelson, S., Sokaras, D., Kunnus, K., Driel, T. B., Hartsock, et al
  2021; 12 (1): 1086
- **Photodissociation of aqueous I3- observed with liquid-phase ultrafast mega-electronvolt electron diffraction** *Structural Dynamics*
  Ledbetter, K., et al
  2020; 21: 10
- **Origin of core-to-core x-ray emission spectroscopy sensitivity to structural dynamics.** *Structural dynamics (Melville, N.Y.)*
  Vacher, M., Kunnus, K., Delcey, M. G., Gaffney, K. J., Lundberg, M.
  2020; 7 (4): 044102
- **Vibrational wavepacket dynamics in Fe carbene photosensitizer determined with femtosecond X-ray emission and scattering.** *Nature communications*
  Kunnus, K., Vacher, M., Harlang, T. C., Kjar, K. S., Haldrup, K., Biasin, E., van Driel, T. B., Papai, M., Chabera, P., Liu, Y., Tatsuno, H., Timm, C., Kallman, et al
  2020; 11 (1): 634
- **Simulations of valence excited states in coordination complexes reached through hard X-ray scattering.** *Physical chemistry chemical physics : PCCP*
  Källman, E. n., Guo, M. n., Delcey, M. G., Meyer, D. A., Gaffney, K. J., Lindh, R. n., Lundberg, M. n.
  2020; 22 (16): 8325–35
- **Femtosecond electronic structure response to high intensity XFEL pulses probed by iron X-ray emission spectroscopy.** *Scientific reports*
  Alonso-Mori, R. n., Sokaras, D. n., Cammarata, M. n., Ding, Y. n., Feng, Y. n., Fritz, D. n., Gaffney, K. J., Hastings, J. n., Kao, C. C., Lemke, H. T., Maxwell, T. n., Robert, A. n., Schropp, et al
  2020; 10 (1): 16837
- **Excited state charge distribution and bond expansion of ferrous complexes observed with femtosecond valence-to-core x-ray emission spectroscopy** *Journal of Chemical Physics*
  Ledbetter, K., Reinhard, M. E., Kunnus, K., Gallo, A., Britz, A., Biasin, E., Glownia, J. M., Nelson, S., Van Driel, T. B., Weninger, C., Zederkof, D. B., Haldrup, K., Cordones, et al
  2020; 152
- **Finding intersections between electronic excited state potential energy surfaces with simultaneous ultrafast X-ray scattering and spectroscopy.** *Chemical science*
  Kjar, K. S., Van Driel, T. B., Harlang, T. C., Kunnus, K., Biasin, E., Ledbetter, K., Hartsock, R. W., Reinhard, M. E., Koroidov, S., Li, L., Laursen, M. G., Hansen, F. B., Vester, et al
  2019; 10 (22): 5749–60
- **Ultrafast X-Ray Scattering Measurements of Coherent Structural Dynamics on the Ground-State Potential Energy Surface of a Diplatinum Molecule** *PHYSICAL REVIEW LETTERS*
  Haldrup, K., Levi, G., Biasin, E., Vester, P., Laursen, M., Beyer, F., Kjaer, K., van Driel, T., Harlang, T., Dohn, A. O., Hartsock, R. J., Nelson, S., Glownia, et al
  2019; 122 (6): 063001
- **Initial metal-metal bond breakage detected by fs X-ray scattering in the photolysis of Ru-3(CO)(12) in cyclohexane at 400 nm** *PHOTOCHEMICAL & PHOTOBIOLOGICAL SCIENCES*
  Kong, Q. Y., Laursen, M. G., Haldrup, K., Kjaer, K. S., Khakhulin, D., Biasin, E., van Driel, T. B., Wulff, M., Kabanova, V., Vuilleumier, R., Bratos, S., Nielsen, M. M., Gaffney, et al
  2019; 18 (2): 319–27
- **Soft X-ray spectroscopy with transition-edge sensors at Stanford Synchrotron Radiation Lightsource beamline 10-1** *Review of Scientific Instruments*
  Lee, S., Titus, C. J., Alonso-Mori, R., Baker, M. L., Bennett, D. A., Cho, H., Doriese, W. B., Fowler, J. W., Gaffney, K. J., Gallo, A., Gard, J. D., Hilton, G. C., Jang, et al
  2019; 90

- **Hot Branching Dynamics in a Light-Harvesting Iron Carbene Complex Revealed by Ultrafast X-ray Emission Spectroscopy.** *Angewandte Chemie (International ed. in English)*
  Tatsuno, H. n., Kjaer, K. S., Kunnus, K. n., Harlang, T. C., Timm, C. n., Guo, M. n., Chàbera, P. n., Fredin, L. A., Hartsock, R. W., Reinhard, M. E., Koroidov, S. n., Li, L. n., Cordones, et al
  2019

- **Probing the Electron Accepting Orbitals of Ni-Centered Hydrogen Evolution Catalysts with Noninnocent Ligands by Ni L-Edge and S K-Edge X-ray Absorption** *INORGANIC CHEMISTRY*
  Koroidov, S., Hong, K., Kjaer, K. S., Li, L., Kunnus, K., Reinhard, M., Hartsock, R. W., Amit, D., Eisenberg, R., Das Pemmaraju, C., Gaffney, K. J., Cordones, A. A.
  2018; 57 (21): 13167–75

- **Disentangling Transient Charge Density and Metal-Ligand Covalency in Photoexcited Ferricyanide with Femtosecond Resonant Inelastic Soft X-ray Scattering** *JOURNAL OF PHYSICAL CHEMISTRY LETTERS*
  Jay, R. M., Norell, J., Eckert, S., Hantschmann, M., Beye, M., Kennedy, B., Quevedo, W., Schlotter, W. F., Dakovski, G. L., Minitti, M. P., Hoffmann, M. C., Mitra, A., Moeller, et al
  2018; 9 (12): 3538–43

- **Fingerprints of electronic, spin and structural dynamics from resonant inelastic soft X-ray scattering in transient photo-chemical species** *PHYSICAL CHEMISTRY CHEMICAL PHYSICS*
  Norell, J., Jay, R. M., Hantschmann, M., Eckert, S., Guo, M., Gaffney, K. J., Wernet, P., Lundberg, M., Foehlisch, A., Odelius, M.
  2018; 20 (10): 7243–53

- **Anisotropy enhanced X-ray scattering from solvated transition metal complexes** *JOURNAL OF SYNCHROTRON RADIATION*
  Biasin, E., van Driel, T. B., Levi, G., Laursen, M. G., Dohn, A. O., Moltke, A., Vester, P., Hansen, F. B. K., Kjaer, K. S., Harlang, T., Hartsock, R., Christensen, M., Gaffney, et al
  2018; 25: 306–15

- **Solvent control of charge transfer excited state relaxation pathways in [Fe(2,2 '-bipyridine)(CN)(4)](2-)** *PHYSICAL CHEMISTRY CHEMICAL PHYSICS*
  Kjaer, K. S., Kunnus, K., Harlang, T. C. B., Van Driel, T. B., Ledbetter, K., Hartsock, R. W., Reinhard, M. E., Koroidov, S., Li, L., Laursen, M. G., Biasin, E., Hansen, F. B., Vester, et al
  2018; 20 (6): 4238–49

- **L-edge spectroscopy of dilute, radiation-sensitive systems using a transition-edge-sensor array** *JOURNAL OF CHEMICAL PHYSICS*
  Titus, C. J., Baker, M. L., Lee, S., Cho, H., Doriese, W. B., Fowler, J. W., Gaffney, K., Gard, J. D., Hilton, G. C., Kenney, C., Knight, J., Li, D., Marks, et al
  2017; 147 (21): 214201

- **Ligand manipulation of charge transfer excited state relaxation and spin crossover in [Fe(2,2 '- bipyridine)(2)(CN)(2)]** *STRUCTURAL DYNAMICS*
  Kjaer, K. S., Zhang, W., Alonso-Mori, R., Bergmann, U., Chollet, M., Hadt, R. G., Hartsock, R. W., Harlang, T., Kroll, T., Kubicek, K., Lemke, H. T., Liang, H. W., Liu, et al
  2017; 4 (4): 044030

- **Metalloprotein entatic control of ligand-metal bonds quantified by ultrafast x-ray spectroscopy** *SCIENCE*
  Mara, M. W., Hadt, R. G., Reinhard, M., Kroll, T., Lim, H., Hartsock, R. W., Alonso-Mori, R., Chollet, M., Glownia, J. M., Nelson, S., Sokaras, D., Kunnus, K., Hodgson, et al
  2017; 356 (6344): 1276-+

- **Probing ultrafast pi pi*/n pi* internal conversion in organic chromophores via K-edge resonant absorption** *NATURE COMMUNICATIONS*
  Wolf, T. A., Myhre, R. H., Cryan, J. P., Coriani, S., Squibb, R. J., Battistoni, A., Berrah, N., Bostedt, C., Bucksbaum, P., Coslovich, G., Feifel, R., Gaffney, K. J., Grilj, et al
  2017; 8: 29

- **Coherent structural trapping through wave packet dispersion during photoinduced spin state switching** *NATURE COMMUNICATIONS*
  Lemke, H. T., Kjaer, K. S., Hartsock, R., van Driel, T. B., Chollet, M., Glownia, J. M., Song, S., Zhu, D., Pace, E., Matar, S. F., Nielsen, M. M., Benfatto, M., Gaffney, et al
  2017; 8

- **Charge and Spin-State Characterization of Cobalt Bis(o-dioxolene) Valence Tautomers Using Co K beta X-ray Emission and L-Edge X-ray Absorption Spectroscopies** *INORGANIC CHEMISTRY*

Liang, H. W., Kroll, T., Nordlund, D., Weng, T., Sokaras, D., Pierpont, C. G., Gaffney, K. J.
2017; 56 (2): 737-747

- **Manipulating charge transfer excited state relaxation and spin crossover in iron coordination complexes with ligand substitution** *CHEMICAL SCIENCE*
  Zhang, W., Kjaer, K. S., Alonso-Mori, R., Bergmann, U., Chollet, M., Fredin, L. A., Hadt, R. G., Hartsock, R. W., Harlang, T., Kroll, T., Kubicek, K., Lemke, H. T., Liang, et al
  2017; 8 (1): 515-523

- **Atomistic characterization of the active-site solvation dynamics of a model photocatalyst** *NATURE COMMUNICATIONS*
  van Driel, T. B., Kjaer, K. S., Hartsock, R. W., Dohn, A. O., Harlang, T., Chollet, M., Christensen, M., Gawelda, W., Henriksen, N. E., Kim, J. G., Haldrup, K., Kim, K. H., Ihee, et al
  2016; 7

- **Anti-Stokes resonant x-ray Raman scattering for atom specific and excited state selective dynamics** *NEW JOURNAL OF PHYSICS*
  Kunnus, K., Josefsson, I., Rajkovic, I., Schreck, S., Quevedo, W., Beye, M., Greubel, S., Scholz, M., Nordlund, D., Zhang, W., Hartsock, R. W., Gaffney, K. J., Schlotter, et al
  2016; 18

- **Viewing the Valence Electronic Structure of Ferric and Ferrous Hexacyanide in Solution from the Fe and Cyanide Perspectives** *JOURNAL OF PHYSICAL CHEMISTRY B*
  Kunnus, K., Zhang, W., Delcey, M. G., Pinjari, R. V., Miedema, P. S., Schreck, S., Quevedo, W., Schroeder, H., Foehlisch, A., Gaffney, K. J., Lundberg, M., Odelius, M., Wernet, et al
  2016; 120 (29): 7182-7194

- **Identification of the dominant photochemical pathways and mechanistic insights to the ultrafast ligand exchange of Fe(CO)5 to Fe(CO)4EtOH.** *Structural dynamics*
  Kunnus, K., JOSEFSSON, I., RAJKOVIC, I., Schreck, S., Quevedo, W., Beye, M., Weniger, C., Grübel, S., Scholz, M., Nordlund, D., Zhang, W., Hartsock, R. W., Gaffney, et al
  2016; 3 (4): 043204-?

- **Femtosecond X-Ray Scattering Study of Ultrafast Photoinduced Structural Dynamics in Solvated [Co(terpy)(2)](2+)** *PHYSICAL REVIEW LETTERS*
  Biasin, E., van Driel, T., Kjaer, K. S., Dohn, A. O., Christensen, M., Harlang, T., Chabera, P., Liu, Y., Uhlig, J., Papai, M., Nemeth, Z., Hartsock, R., Liang, et al
  2016; 117 (1): 013002

- **Diffractive imaging of a rotational wavepacket in nitrogen molecules with femtosecond megaelectronvolt electron pulses** *NATURE COMMUNICATIONS*
  Yang, J., Guehr, M., Vecchione, T., Robinson, M. S., Li, R., Hartmann, N., Shen, X., Coffee, R., Corbett, J., Fry, A., Gaffney, K., Gorkhover, T., Hast, et al
  2016; 7

- **Femtosecond gas phase electron diffraction with MeV electrons** *FARADAY DISCUSSIONS*
  Yang, J., Guehr, M., Vecchione, T., Robinson, M. S., Li, R., Hartmann, N., Shen, X., Coffee, R., Corbett, J., Fry, A., Gaffney, K., Gorkhover, T., Hast, et al
  2016; 194: 563–81

- **Orbital-specific mapping of the ligand exchange dynamics of Fe(CO)(5) in solution** *NATURE*
  Wernet, P., Kunnus, K., JOSEFSSON, I., RAJKOVIC, I., Quevedo, W., Beye, M., Schreck, S., Gruebel, S., Scholz, M., Nordlund, D., Zhang, W., Hartsock, R. W., Schlotter, et al
  2015; 520 (7545): 78-81

- **Mechanistic Studies of Photoinduced Spin Crossover and Electron Transfer in Inorganic Complexes** *ACCOUNTS OF CHEMICAL RESEARCH*
  Zhang, W., Gaffney, K. J.
  2015; 48 (4): 1140-1148

- **Ultrafast X-ray Auger probing of photoexcited molecular dynamics** *NATURE COMMUNICATIONS*
  McFarland, B. K., Farrell, J. P., Miyabe, S., Tarantelli, F., Aguilar, A., Berrah, N., Bostedt, C., Bozek, J. D., Bucksbaum, P. H., Castagna, J. C., Coffee, R. N., Cryan, J. P., Fang, et al
  2014; 5

- **Tracking excited-state charge and spin dynamics in iron coordination complexes.** *Nature*
  Zhang, W., Alonso-Mori, R., Bergmann, U., Bressler, C., Chollet, M., Galler, A., Gawelda, W., Hadt, R. G., Hartsock, R. W., Kroll, T., Kjær, K. S., Kubicek, K., Lemke, et al
  2014; 509 (7500): 345-348

- **Contact Ion Pair Formation between Hard Acids and Soft Bases in Aqueous Solutions Observed with 2DIR Spectroscopy** *JOURNAL OF PHYSICAL CHEMISTRY B*
  Sun, Z., Zhang, W., Ji, M., Hartsock, R., Gaffney, K. J.
  2013; 117 (49): 15306-15312

- **Fourier-transform inelastic X-ray scattering from time- and momentum-dependent phonon-phonon correlations** *NATURE PHYSICS*
  Trigo, M., Fuchs, M., Chen, J., Jiang, M. P., Cammarata, M., Fahy, S., Fritz, D. M., Gaffney, K., Ghimire, S., Higginbotham, A., Johnson, S. L., Kozina, M. E., Larsson, et al
  2013; 9 (12): 790-794

- **Aqueous Mg(2+) and Ca(2+) Ligand Exchange Mechanisms Identified with 2DIR Spectroscopy.** *journal of physical chemistry. B*
  Sun, Z., Zhang, W., Ji, M., Hartsock, R., Gaffney, K. J.
  2013; 117 (40): 12268-12275

- **Femtosecond X-ray Absorption Spectroscopy at a Hard X-ray Free Electron Laser: Application to Spin Crossover Dynamics** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Lemke, H. T., Bressler, C., Chen, L. X., Fritz, D. M., Gaffney, K. J., Galler, A., Gawelda, W., Haldrup, K., Hartsock, R. W., Ihee, H., Kim, J., Kim, K., Lee, et al
  2013; 117 (4): 735–40

- **A setup for resonant inelastic soft x-ray scattering on liquids at free electron laser light sources** *REVIEW OF SCIENTIFIC INSTRUMENTS*
  Kunnus, K., Rajkovic, I., Schreck, S., Quevedo, W., Eckert, S., Beye, M., Suljoti, E., Weniger, C., Kalus, C., Gruebel, S., Scholz, M., Nordlund, D., Zhang, et al
  2012; 83 (12)

- **Site-Specific Measurement of Water Dynamics in the Substrate Pocket of Ketosteroid Isomerase Using Time-Resolved Vibrational Spectroscopy** *JOURNAL OF PHYSICAL CHEMISTRY B*
  Jha, S. K., Ji, M., Gaffney, K. J., Boxer, S. G.
  2012; 116 (37): 11414-11421

- **Resolving Photo-Induced Twisted Intramolecular Charge Transfer with Vibrational Anisotropy and TDDFT** *JOURNAL OF PHYSICAL CHEMISTRY B*
  Zhang, W., Lan, Z., Sun, Z., Gaffney, K. J.
  2012; 116 (37): 11527-11536

- **Dynamics of Solvent-Mediated Electron Localization in Electronically Excited Hexacyanoferrate(III)** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*
  Zhang, W., Ji, M., Sun, Z., Gaffney, K. J.
  2012; 134 (5): 2581-2588

- **Influence of solute-solvent coordination on the orientational relaxation of ion assemblies in polar solvents** *JOURNAL OF CHEMICAL PHYSICS*
  Ji, M., Hartsock, R. W., Sung, Z., Gaffney, K. J.
  2012; 136 (1)

- **Interdependence of Conformational and Chemical Reaction Dynamics during Ion Assembly in Polar Solvents** *JOURNAL OF PHYSICAL CHEMISTRY B*
  Ji, M., Hartsock, R. W., Sun, Z., Gaffney, K. J.
  2011; 115 (39): 11399-11408

- **Direct measurement of the protein response to an electrostatic perturbation that mimics the catalytic cycle in ketosteroid isomerase** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Jha, S. K., Ji, M., Gaffney, K. J., Boxer, S. G.
  2011; 108 (40): 16612-16617

- **Characterizing the Deformational Isomers of Bimetallic Ir-2(dimen)(4)(2+) (dimen=1,8-diisocyano-p-menthane) with Vibrational Wavepacket Dynamics** *JOURNAL OF PHYSICAL CHEMISTRY A*

Hartsock, R. W., Zhang, W., Hill, M. G., Sabat, B., Gaffney, K. J.
2011; 115 (14): 2920-2926

- **H-bond switching and ligand exchange dynamics in aqueous ionic solution** *CHEMICAL PHYSICS LETTERS*
  Gaffney, K. J., Ji, M., Odelius, M., Park, S., Sun, Z.
  2011; 504 (1-3): 1-6
- **Orientational relaxation dynamics in aqueous ionic solution: Polarization-selective two-dimensional infrared study of angular jump-exchange dynamics in aqueous 6M NaClO4** *JOURNAL OF CHEMICAL PHYSICS*
  Ji, M., Gaffney, K. J.
  2011; 134 (4)
- **Dynamics of Ion Assembly in Solution: 2DIR Spectroscopy Study of LiNCS in Benzonitrile** *JOURNAL OF PHYSICAL CHEMISTRY LETTERS*
  Ji, M., Park, S., Gaffney, K. J.
  2010; 1 (12): 1771-1775
- **Large Angular Jump Mechanism Observed for Hydrogen Bond Exchange in Aqueous Perchlorate Solution** *SCIENCE*
  Ji, M., Odelius, M., Gaffney, K. J.
  2010; 328 (5981): 1003-1005
- **Ligand Exchange Dynamics in Aqueous Solution Studied with 2DIR Spectroscopy** *JOURNAL OF PHYSICAL CHEMISTRY B*
  Park, S., Ji, M., Gaffney, K. J.
  2010; 114 (19): 6693-6702
- **Characterization of charge transfer excitations in hexacyanomanganate(III) with Mn K-edge resonant inelastic x-ray scattering** *JOURNAL OF CHEMICAL PHYSICS*
  Meyer, D. A., Zhang, X., Bergmann, U., Gaffney, K. J.
  2010; 132 (13)
- **Atomic resolution mapping of the excited-state electronic structure of Cu2O with time-resolved x-ray absorption spectroscopy** *PHYSICAL REVIEW B*
  Hillyard, P. W., Kuchibhatla, S. V., Glover, T. E., Hertlein, M. P., Huse, N., Nachimuthu, P., Saraf, L. V., Thevuthasan, S., Gaffney, K. J.
  2009; 80 (12)
- **Ultrafast Dynamics of Hydrogen Bond Exchange in Aqueous Ionic Solutions** *JOURNAL OF PHYSICAL CHEMISTRY B*
  Park, S., Odelius, M., Gaffney, K. J.
  2009; 113 (22): 7825-7835
- **Efficient Multiple Exciton Generation Observed in Colloidal PbSe Quantum Dots with Temporally and Spectrally Resolved Intraband Excitation** *NANO LETTERS*
  Ji, M., Park, S., Connor, S. T., Mokari, T., Cui, Y., Gaffney, K. J.
  2009; 9 (3): 1217-1222
- **Carrier-induced disordering dynamics in InSb studied with density functional perturbation theory** *PHYSICAL REVIEW B*
  Hillyard, P. B., Reis, D. A., Gaffney, K. J.
  2008; 77 (19)
- **X-ray diffuse scattering measurements of nucleation dynamics at femtosecond resolution** *PHYSICAL REVIEW LETTERS*
  Lindenberg, A. M., Engemann, S., Gaffney, K. J., Sokolowski-Tinten, K., Larsson, J., Hillyard, P. B., Reis, D. A., Fritz, D. M., ARTHUR, J., Akre, R. A., George, M. J., Deb, A., Bucksbaum, et al
  2008; 100 (13)
- **Imaging atomic structure and dynamics with ultrafast X-ray scattering** *SCIENCE*
  Gaffney, K. J., Chapman, H. N.
  2007; 316 (5830): 1444-1448
- **Carrier-density-dependent lattice stability in InSb** *PHYSICAL REVIEW LETTERS*
  Hillyard, P. B., Gaffney, K. J., Lindenberg, A. M., Engemann, S., Akre, R. A., ARTHUR, J., Blome, C., Bucksbaum, P. H., Cavalieri, A. L., Deb, A., Falcone, R. W., Fritz, D. M., Fuoss, et al
  2007; 98 (12)

- **Ultrafast bond softening in bismuth: Mapping a solid's interatomic potential with X-rays** *SCIENCE*
  Fritz, D. M., Reis, D. A., Adams, B., Akre, R. A., ARTHUR, J., Blome, C., Bucksbaum, P. H., Cavalieri, A. L., Engemann, S., Fahy, S., Falcone, R. W., Fuoss, P. H., Gaffney, et al
  2007; 315 (5812): 633-636

- **Ultrafast dynamics of laser-excited solids** *MRS BULLETIN*
  Reis, D. A., Gaffney, K. J., Gilmer, G. H., Torralva, B.
  2006; 31 (8): 601-606

- **Observation of structural anisotropy and the onset of liquidlike motion during the nonthermal melting of InSb** *PHYSICAL REVIEW LETTERS*
  Gaffney, K. J., Lindenberg, A. M., Larsson, J., Sokolowski-Tinten, K., Blome, C., Synnergren, O., Sheppard, J., Caleman, C., MacPhee, A. G., Weinstein, D., Lowney, D. P., Allison, T., Matthews, et al
  2005; 95 (12)

- **Atomic-scale visualization of inertial dynamics** *SCIENCE*
  Lindenberg, A. M., Larsson, J., Sokolowski-Tinten, K., Gaffney, K. J., Blome, C., Synnergren, O., Sheppard, J., Caleman, C., MacPhee, A. G., Weinstein, D., Lowney, D. P., Allison, T. K., Matthews, et al
  2005; 308 (5720): 392-395

- **Clocking femtosecond x rays** *PHYSICAL REVIEW LETTERS*
  Cavalieri, A. L., Fritz, D. M., Lee, S. H., Bucksbaum, P. H., Reis, D. A., Rudati, J., Mills, D. M., Fuoss, P. H., Stephenson, G. B., Kao, C. C., Siddons, D. P., Lowney, D. P., MacPhee, et al
  2005; 94 (11)

- **Measurement and dynamics of the spatial distribution of an electron localized at a metal-dielectric interface** *JOURNAL OF CHEMICAL PHYSICS*
  Bezel, Gaffney, K. J., Garrett-Roe, S., Liu, S. H., Miller, A. D., Szymanski, P., Harris, C. B.
  2004; 120 (2): 845–56

- **Hydrogen bond breaking probed with multidimensional stimulated vibrational echo correlation spectroscopy** *JOURNAL OF CHEMICAL PHYSICS*
  Asbury, J. B., Steinel, T., Stromberg, C., Gaffney, K. J., Piletic, I. R., Fayer, M. D.
  2003; 119 (24): 12981-12997

- **Hydrogen bond dynamics probed with ultrafast infrared heterodyne-detected multidimensional vibrational stimulated echoes** *PHYSICAL REVIEW LETTERS*
  Asbury, J. B., Steinel, T., Stromberg, C., Gaffney, K. J., Piletic, I. R., Goun, A., Fayer, M. D.
  2003; 91 (23)

- **Structural dynamics of hydrogen bonded methanol oligomers: Vibrational transient hole burning studies of spectral diffusion** *JOURNAL OF CHEMICAL PHYSICS*
  Piletic, I. R., Gaffney, K. J., Fayer, M. D.
  2003; 119 (1): 423-434

- **Ultrafast heterodyne detected infrared multidimensional vibrational stimulated echo studies of hydrogen bond dynamics** *CHEMICAL PHYSICS LETTERS*
  Asbury, J. B., Steinel, T., Stromberg, C., Gaffney, K. J., Piletic, I. R., Goun, A., Fayer, M. D.
  2003; 374 (3-4): 362-371

- **Orientational relaxation and vibrational excitation transfer in methanol-carbon tetrachloride solutions** *JOURNAL OF CHEMICAL PHYSICS*
  Gaffney, K. J., Piletic, I. R., Fayer, M. D.
  2003; 118 (5): 2270-2278

- **Hydrogen bond dissociation and reformation in methanol oligomers following hydroxyl stretch relaxation** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Gaffney, K. J., Davis, P. H., Piletic, I. R., Levinger, N. E., Fayer, M. D.
  2002; 106 (50): 12012-12023

- **Direct observation of two-dimensional electron solvation at alcohol/Ag(111) interfaces** *JOURNAL OF PHYSICAL CHEMISTRY B*
  Liu, S. H., Miller, A. D., Gaffney, K. J., Szymanski, P., Garrett-Roe, S., Bezel, Harris, C. B.

2002; 106 (50): 12908–15

- **Hydrogen bond breaking and reformation in alcohol oligomers following vibrational relaxation of a non-hydrogen-bond donating hydroxyl stretch** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Gaffney, K. J., Piletic, I. R., Fayer, M. D.
  2002; 106 (41): 9428-9435
- **Evolution of a two-dimensional band structure at a self-assembling interface** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Miller, A. D., Gaffney, K. J., Liu, S. H., Szymanski, P., Garrett-Roe, S., Wong, C. M., Harris, C. B.
  2002; 106 (33): 7636–38
- **Electron solvation in two dimensions** *SCIENCE*
  Miller, A. D., Bezel, Gaffney, K. J., Garrett-Roe, S., Liu, S. H., Szymanski, P., Harris, C. B.
  2002; 297 (5584): 1163–66
- **Femtosecond dynamics of electrons photoinjected into organic semiconductors at aromatic-metal interfaces** *JOURNAL OF PHYSICAL CHEMISTRY B*
  Gaffney, K. J., Miller, A. D., Liu, S. H., Harris, C. B.
  2001; 105 (38): 9031–39
- **The adsorbate electron affinity dependence of femtosecond electron dynamics at dielectric/metal interfaces**
  Gaffney, K. J., Liu, S. H., Miller, A. D., Szymanski, P., Harris, C. B.
  WILEY-V C H VERLAG GMBH.2000: 759–63
- **Femtosecond electron dynamics at the benzene/Ag(111) interface** *CHEMICAL PHYSICS*
  Gaffney, K. J., Wong, C. M., Liu, S. H., Miller, A. D., McNeill, J. D., Harris, C. B.
  2000; 251 (1-3): 99–110
- **Femtosecond studies of electron dynamics at dielectric-metal interfaces** *JOURNAL OF PHYSICAL CHEMISTRY B*
  Wong, C. M., McNeill, J. D., Gaffney, K. J., Ge, N. H., Miller, A. D., Liu, S. H., Harris, C. B.
  1999; 103 (2): 282–92
- **Femtosecond dynamics of electron localization at interfaces** *SCIENCE*
  Ge, N. H., Wong, C. M., Lingle, R. L., McNeill, J. D., Gaffney, K. J., Harris, C. B.
  1998; 279 (5348): 202–5