

PHYSICAL CHEMISTRY SEMINAR

Wednesday, February 28, 2024

10:30-11:30 a.m. BRWN 4102

"Imaging Chemical Transformations with Ultrafast X-ray Lasers"

Kelly J. Gaffney

Professor of Photon Science

Pulse Institute,

SLAC National Accelerator Laboratory
and Stanford University



Abstract:

The efficient and directed use of light for chemical applications requires directing the electronic and nuclear motion of molecules on electronic excited states toward the desired chemical outcomes. While ultrafast optical lasers have long been able to capture ultrafast chemical reaction dynamics, interpretation has often proved ambiguous. The advent of ultrafast x-ray lasers provides a novel approach to imaging chemical dynamics with unprecedented spatial and temporal resolution. I will present mechanistic studies of the back electron transfer and intersystem crossing dynamics that occur following electronic excitation in iron-carbene based photosensitizers. These experiments have combined the simultaneous measurement of hard x-ray emission spectroscopy (XES) to track the charge and spin dynamics of the metal site with x-ray solution scattering (XSS) to characterize changes in the intramolecular metal-ligand bonding. We intend to use the mechanistic understanding extracted from these measurements to inform the design of transition metal complexes for photosensitizer and photocatalysis applications.



Department of Chemistry