Department of Chemistry & Biochemistry Seminar

Friday, February 5th, 2021

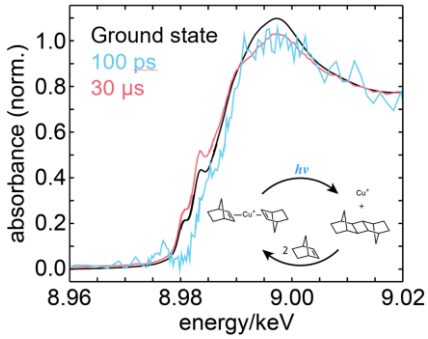
1:30pm – 2:45pm

Zoom ID: 960 452 0800

Password: Optical

Combining Optical and X-ray Transient Absorption Spectroscopies to Investigate Photochemistry at Transition Metals

Speaker: ***Dr. Dugan Hayes***, **University of Rhode Island**



Abstract: Conventional ultrafast optical spectroscopies are incredibly powerful tools for characterizing electronic excited-state dynamics. When the system of interest contains a transition metal, however, we may also take advantage of the element specificity of X-ray absorption spectroscopies to provide complementary information. To introduce the power of X-ray absorption for tracking changes in oxidation state, I will first present a real-time investigation of the oxidative degradation of tin halide perovskite thin films, a promising class of next-generation photovoltaic materials that currently suffer from prohibitively short shelf-lives. Afterwards I will demonstrate how we have used the experimental synergy between optical and X-ray transient absorption techniques to investigate the mechanisms of photochemical reactions on the femtosecond to microsecond timescales through our work on the copper-catalyzed [2 + 2] photocycloaddition reaction. We have found the dimerization of norbornene to proceed through an initial metal-to-ligand charge transfer state but the dimerization of cyclohexene to follow an entirely different mechanism that could involve photoinduced *cis-trans* isomerization of the substrate. We are currently extending these studies to the intramolecular cyclization of linear dienes with the goal of uncovering the origin of the strict regioselectivity of this reaction.

Biography: Dugan Hayes is an Assistant Professor in the Department of Chemistry at the University of Rhode Island, where he has been since 2017. He received his Ph.D. in physical chemistry from the University of Chicago in 2013, and he was the Joseph J. Katz Postdoctoral Fellow at Argonne National Laboratory from 2014 to 2017. He is a frequent user of the Advanced Photon Source, an X-ray user facility operated by the Department of Energy where he and his research group perform a variety of time-resolved and steady-state X-ray spectroscopies. In addition to improving next-generation solar energy materials, he is interested in uncovering the mechanisms of synthetically useful photochemical reactions and developing novel nuclear resonance spectroscopic techniques.