SPRING 2023 CHEMISTRY SEMINAR SERIES

DR. DUGAN HAYES

Department of Chemistry

University of Rhode Island, Kingston, RI

HOST: DR. LOCKARD

ALL THOSE INTERESTED ARE WELCOME TO ATTEND

"Spectroscopic tools spanning the electromagnetic spectrum for mechanistic studies of photochemistry"

Friday, March 31, 2023, 11:30 AM
Life Science Center II, Room 130

Abstract: The powerful combination of ultrafast optical transient absorption spectroscopy with element-specific time-resolved X-ray and/or gamma ray techniques at synchrotron facilities can provide a comprehensive picture of complex photochemical mechanisms involving transition metals and post-transition metals. In this talk, I will present three recent examples of such work from my group, beginning with our investigation of the Cu(I)-catalyzed [2 + 2] photocycloaddition reaction. By observing the intermolecular dimerizations of two model cyclic olefins from femtosecond to microsecond timescales, we have found that this photocatalytic reaction may be directed along strikingly disparate trajectories through only very minor changes to the structure of the substrate. Next, I will present our work identifying the timescales, intermediates, and branching ratios for the competing photochemical and photophysical relaxation pathways of the aqueous ferrate(VI) ion, a remarkable example of an air-stable hexavalent iron complex that is an excellent source of oxidizing potential in both catalysis and energy storage applications. Finally, I will conclude by discussing our progress toward nuclear resonance (i.e., Mössbauer) pump-probe spectroscopies using our recent measurement of time-resolved nuclear forward scattering from photoexcited tin(II) oxide as a proof-of-principle example.

Biographical Sketch: Dugan Hayes has been an Assistant Professor in the Department of Chemistry at the University of Rhode Island 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. His research is focused on using time-resolved spectroscopies to uncover the mechanisms of synthetically useful photochemical reactions and using organic chromophores at platforms for discovering novel photochemistry. He and his group are frequent users of the Advanced Photon Source and other X-ray user facilities and have been awarded over 50 weeks of beamtime for their research. Most recently he was the recipient of a DOE Early Career Award.

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