

PHYSICAL CHEMISTRY SEMINAR



Prof. Dugan Hayes

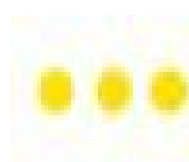
Department of Chemistry
 University of Rhode Island

Monday, April 3, 2023

4:00 PM | YH 4222

Mani L. Bhaumik Collaboratory -
 Dongwon Yoo Seminar & Conference Hall

Time-resolved Spectroscopic Tools for Mechanistic Studies of Organic and Inorganic Photochemistry



Abstract: Ultrafast optical spectroscopies are powerful tools for characterizing electronic excited state dynamics in homogeneous photochemistry. When the system of interest contains a transition metal, we may also take advantage of the element specificity of X-ray spectroscopies to provide complementary information. I will provide two examples of recent work from my group that take advantage of the powerful combination of these techniques to disentangle photochemical and photophysical pathways. First, I will present our investigation of the Cu(I)-catalyzed [2 + 2] photocycloaddition reaction, which provides a simple, single-step route to cyclobutanes in organic syntheses. By observing the intermolecular dimerizations of two model olefins, we have found that this photocatalytic reaction may be directed along strikingly disparate trajectories through only very minor changes in substrate structure. These insights have since allowed us to overcome the limitations of intramolecular [2 + 2] photocycloadditions and thereby broaden the scope of such reactions. Next, I will present our work on 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. We have identified the timescales, intermediates, and branching ratios for the competing photochemical and photophysical relaxation pathways of the ferrate(VI) ligand-to-metal charge transfer state, which will help guide environmental engineering efforts toward novel, non-toxic methods of oxidative water treatment. Finally, I will discuss how we have used organic chromophores as platforms for the discovery of novel photochemical reactions with unique regioselectivity and give several examples of such transformations.

Please contact isaiahgtz@chem.ucla.edu for additional information.