“In situ transient absorption spectroscopy during materials formation”

Molecules, polymers, and nanocrystals can form the active layer in electronic devices such as photovoltaics and light-emitting diodes. Their electronic structure and excited state dynamics dictate their function and suitability for these applications. Transient absorption (TA) spectroscopy is used to measure these properties, and has provided remarkable insights into the behavior and function of electronic materials. However, multiple minutes-to-hours are typically required to perform these measurements, making it difficult to accurately measure the excited state dynamics of unstable and evolving materials systems such as electronic materials during their synthesis or deposition into a thin film. In this seminar, I will introduce a novel implementation of TA spectroscopy that can measure transient spectra in 8 ms, with good signal-to-noise achieved in ~30 s. This new technique is applied to the study of organic molecules during their aggregation into a thin film, as well as lead-halide perovskite nanocrystals during their synthesis. These examples demonstrate that in addition to providing an understanding of how excited state dynamics change during materials formation, TA signals measured in situ can reveal new insights into the mechanisms of complex materials formation processes.