Title: Hadamard-Transform Excitation-Emission-Matrix (HT-EEM) Spectroscopy: Rapid Multidimensional Analysis of Fluorophores

Abstract:

Excitation-emission-matrix (EEM) spectroscopy is a two-dimensional technique commonly used to analyze complex fluorescent mixtures. This allows for easy identification and quantification of the species within a sample. However, conventional EEM spectrometers acquire a single high-quality spectrum in several minutes to an hour since they are wasteful of light. These long acquisition times make it nearly impossible to do an online analysis of fast processes using EEM spectroscopy. In this seminar, I present two different in-house-built EEM spectrometers, which can acquire a full EEM spectrum in less than a second. The first instrument uses a digital micro-mirror array, which offers adjustable excitation resolution but is limited to only using the visible spectrum of light. The second instrument uses a battery of UV-LEDs and offers faster acquisition and access to UV light excitation but has a fixed excitation resolution. To achieve fast acquisition times, we use the Hadamard-Transform (HT), which is a multiplexing technique designed to offer improved signal-to-noise compared to conventional instruments. This improved signal-to-noise allows us to run our instruments at much faster acquisition rates while still recording similar quality spectra when compared to slower conventional EEM spectrometers. I will discuss the applications of these HT-EEM instruments, including their use for monitoring online kinetics and their use as EEM detectors for HPLC applications.