

## **Harnessing and Shaping Mid-Infrared Light for Biosensing**

The mid-infrared (mid-IR) region of the electromagnetic spectrum, also known as the molecular fingerprint region, has long been a focus of scientific and technological research. Mid-IR microscopy is a non-destructive tool that can measure the molecular content of biological samples by probing fundamental vibrational modes, with potential applications in early disease detection and diagnosis. However, limitations such as long acquisition times, limited spatial detail, and a lack of understanding of light-matter interactions have impeded progress in this field. In this talk, I will present quantum cascade laser-based mid-IR spectroscopic imaging platforms that address these challenges to improve perceived spatial resolution and enabling label-free classification of surgical tissue sections within minutes. Additionally, I will discuss the development of technology for imaging site-specific chirality of molecules, including the specific challenges and roadblocks to creating a viable and accurate system. This talk focuses on developing instrumentation and utilizing theory and modeling to guide the creation of measurement systems, opening new opportunities for sensing biomolecules – in both terrestrial and space environments.