Joanna Atkin – Colloquium seminar - October 28, 2021
UNC

Title: Near-field microscopy for nanoscale materials characterization

Abstract: Conventional far-field optical spectroscopic techniques can provide valuable information about structural, electronic, and temporal properties of materials. However, they are also subject to the diffraction limit of light, which can lead to poor spatial resolution and a high degree of averaging, in particular when studying nanomaterials. Near-field microscopy techniques, in contrast, can break the diffraction limit through the use of a nanometer probe to provide high spatial resolution and access to novel material excitations, but interpretation can be challenging due to the convolutional effects of the near-field interaction. I will discuss experimental and computational considerations in near-field microscopy across a wide spectral range, focusing on applications that demonstrate the importance of understanding the influence of the nanoscale probe and controlling near-field interactions. I will discuss two specific applications of a tailored near-field. The first is the use of infrared near-field optical spectroscopy for non-destructive, in operando chemical, structural, and electronic imaging of semiconducting materials, with the aim of understanding how their local properties affect functionality for optoelectronic and photovoltaic devices. The second application involves exploiting near-field interactions to perform single-molecule structural characterization of biological systems through their vibrational modes.