DEPARTMENT OF PHYSICS AND ASTRONOMY

COLLOQUIUM IN-PERSON ONLY EVENT

Materials Properties in Optically Confined Environments

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Confining electromagnetic radiation to small volumes presents remarkable opportunities for probing and manipulating the structure and dynamics of matter. In this talk, I will provide an overview of two approaches that exemplify this concept: scattering-type scanning near-field optical microscopy (s-SNOM) and optical microcavities. In s-SNOM, we employ a metalized atomic force microscopy (AFM) tip to create a nano-focused electromagnetic field at its apex, enabling the investigation of the properties of molecular and quantum materials that traditional diffraction-limited spectroscopy and microscopy techniques cannot resolve. On the other hand, in optical microcavities, we leverage the confined electromagnetic fields formed between two mirrors to modulate molecular properties without altering their structure. I will begin by presenting our recent findings using s-SNOM, which provides a deeper understanding of the spatial variation in hydrogen bonding interactions within polymer blends. Next, I will demonstrate how s-SNOM can be employed to uncover various structural domains and interfacial phenomena in colloidal nanocrystal thin films. Finally, I will discuss how integrating voltage-tunable optical microcavities with vibrational spectroscopy and laser scanning confocal microscopy can be utilized to tailor the infrared absorption properties of molecular ensembles and the tautomerization dynamics of individual quantum emitters, respectively.

Thursday, January 30, at 3:55 PM

IN-PERSON EVENT ROOM 202

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