MSE FALL SEMINAR SERIES

Title: Seeing the Sound: Optical and Ultrasonic Brain Interfaces Based on Materials Advances

Abstract: Today's optical neuromodulation and imaging methods enable causal manipulation of neural activity to dissect complex circuit connections underlying certain behaviors and facilitate brain-computer interfaces. In these approaches, visible light is commonly used, thus limiting penetration depth *in vivo* and necessitating an invasive procedure that damages the endogenous brain tissue and constrains the subject's free behavior. In this talk, I will present three recently developed methods to address these challenges based on novel material advances: sono-optogenetics, infrared optogenetics, and an intravascular light source. In sono-optogenetics, we demonstrate that mechanoluminescent materials can convert focused ultrasound into localized light emission for noninvasive optogenetic neuromodulation in live mice. In addition, inspired by the infrared sensitivity of rattlesnakes, we developed an approach to use brain-penetrant infrared light for tether-free and implant-free neuromodulation throughout the entire brain in freely behaving mice. Lastly, we leveraged a biomineral-inspired approach to synthesize nanoscopic phosphors as an intravascular light source. In contrast to conventional external light sources, this intravascular light source offers deeper tissue penetration for imaging the mouse brain through the uncleared skull. I will conclude my talk by presenting an outlook on how advances in materials science may facilitate our understanding of the mind.

Date: Thursday, October 6
Time: 4:00 pm
Location: Kimball B11

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