

The Department of  
**Mechanical Engineering**  
PRESENTS

# Yongjie Hu, Ph.D.

ASSISTANT PROFESSOR  
MECHANICAL AND AEROSPACE ENGINEERING  
University of California Los Angeles



Friday, May 10, 2019  
Winston Chung Hall 205/206  
11:10-12:00PM

## ***Energy Transport in Extreme Thermal Materials***

### ***Abstract:***

Heat dissipation has become an increasingly important technological challenge in modern electronics and energy technologies. Discovering new high thermal conductivity materials that can efficiently dissipate heat from hot spots and improve device performance are urgently needed. In this talk, I will describe our recent progress in developing emerging high thermal conductivity semiconductors including boron arsenide (BAs) and boron phosphide (BP). For the first time, we synthesized BAs and BP single crystals without detectable defects, and measured a room temperature thermal conductivity of 1300 W/mK (Science 361, 575, 2018) and 500 W/mK (Nano Letters 17, 7507, 2017) respectively, representing the highest thermal conductivity materials among common semiconductors and metals. Ultrafast spectroscopy study in conjunction with atomistic theory reveals that the unique band structure of BAs allows for very long phonon mean free paths and strong high-order anharmonicity through the four-phonon process. Our study establishes BAs and BP as benchmark materials for thermal management applications, and exemplifies the power of combining experiments and ab initio theory in new materials discovery. In addition, I will describe our effort in developing in-situ techniques to characterize electrochemical materials (Nano Letters 17, 1431, 2017) that enables better fundamental understanding of phonon spectra and defect scattering for applications in batteries, sensors, and quantum information.

### ***About the Speaker:***

Yongjie Hu is an Assistant Professor of Mechanical and Aerospace Engineering at UCLA. His group exploits a variety of interdisciplinary experimental and theoretical approaches to investigate nanoscale energy transport processes, with a current emphasis on developing advanced materials and experimental metrologies to characterize transport mechanisms. Before joining the faculty of UCLA in the fall of 2014, he received his Ph.D. from Harvard University and Battelle Postdoctoral Fellowship from MIT. His research has been recognized by diverse research societies including 2019 Alfred P. Sloan Research Fellowship, 2018 NSF CAREER Award, and 2017 U.S. Air Force Young Investigator Award.