Energy Transfer and Conversion in Nanoscale Gaps

Pramod Reddy, University of Michigan, Ann Arbor

Understanding radiative heat transfer in nanoscale gaps and devices is of great current interest due to the strong potential of nanoscale thermal radiation for creating novel energy conversion devices. In this talk, I will describe ongoing efforts in our group to experimentally elucidate nanoscale radiative heat transfer and leveraging it for developing novel energy conversion technologies. Specifically, I will present our recent experimental work where we have developed and employed novel nano positioning platforms and custom-developed microdevices to perform first systematic experiments that reveal that radiative heat transfer rates in nanometer sized gaps can exceed those set by the blackbody limit by several orders of magnitude. Next, I will discuss how such enhancements in radiative heat transfer rates can enable novel photonic based energy conversion and refrigeration technologies and present experimental data that highlight the promise of these approaches. Finally, I will briefly outline how these technical advances can be leveraged for converting heat to electricity with high efficiency and high power output to develop novel energy conversion technologies that can contribute to a sustainable future.

Bio: Prof. Pramod Reddy received a B. Tech and M. Tech in Mechanical Engineering from the Indian Institute of Technology, Bombay in 2002, and a Ph.D. in Applied Science and Technology from the University of California, Berkeley in 2007. He was a recipient of the NSF CAREER award in 2009, the DARPA Young Faculty Award in 2012, the Young Alumnus Achiever Award from IIT Bombay in 2017 and the University Distinguished Faculty Achievement Award from the University of Michigan in 2020. He is currently a professor in the department of Mechanical Engineering and the department of Materials Science and Engineering at the University of Michigan, Ann Arbor.