



College of Engineering
Department of
Mechanical & Industrial Engineering

The Sidney E. Fuchs Seminar Series

3:00-4:00pm, Friday, April 20, 2018
1263 Patrick F Taylor Hall



Energy Transfer in Nanoscale Gaps and Atomic Junctions

by **Pramod Reddy***

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Understanding radiative and conductive heat transfer in nanoscale gaps and devices is of considerable interest for creating novel energy conversion and information processing devices. In this talk, I will first describe ongoing efforts in our group to experimentally elucidate nanoscale radiative heat transfer. Specifically, I will present our recent experimental work where we have addressed the following questions: Can existing theories accurately describe radiative heat transfer in single nanometer sized gaps¹? Can radiative thermal conductances that are orders of magnitude larger than those between blackbodies be achieved²? In order to address these questions we have developed a variety of instrumentation including novel nanopositioning platforms and microdevices, which will also be described. In addition, I will also discuss recent experimental work^{3,4} from our group where we made first measurements of heat transport and Peltier cooling at the atomic scale to elucidate the novel quantum transport properties that arise in atomic and molecular junctions. Finally, I will briefly outline how these technical advances can be leveraged for future investigations of nanoscale heat transport and near-field thermophotovoltaic energy conversion.

Recent publications from Dr. Reddy's lab: [1] "Radiative heat transfer in the extreme near-field" *Nature* 528, 387-391 (2015); [2] "Radiative heat conductance between dielectric and metallic parallel plates at nanoscale gaps" *Nature Nanotechnology* 11, 509-514 (2016); [3] "Quantized thermal transport in single-atom junctions" *Science* 355, 1192-1195 (2017); [4] "Peltier cooling in molecular junctions" *Nature Nanotechnology* 13, 122-127 (2018) .

* 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 and the Young Alumnus Achiever Award from IIT Bombay in 2017. He is currently an associate professor in the departments of Mechanical Engineering and Materials Science and Engineering at the University of Michigan, Ann Arbor.