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Probing Heat Carriers for Power Generation and Heat Management Applications

Abstract: Nanoscale heat transfer differs distinctively from that in macroscale due to various size effects. Probing nanoscale heat transfer phenomena is extremely challenging. In this talk I will discuss how we can experimentally probe nanoscale transport phenomena for all three heat carriers, electrons, phonons and photons, as they are applied to energy conversion systems. Using a suspended microdevice, I will show how we can reliably measure the electron and phonon transport properties on individual nanowires and patterned thin films for use in thermoelectric application. Using scalable lithographic fabrication processes and standard optical characterization techniques, I will demonstrate how we can manipulate and probe photons by employing an inverted nano-pyramid surface nanostructuring scheme to significantly enhance absorption of solar radiation within crystalline thin film silicon for photovoltaic applications. Finally using a bi-material cantilever, I will describe how we can measure near-field thermal radiation heat transfer between nanoscale gaps and show that it can be orders of magnitude higher than that of the blackbody radiation.

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Biography: Anastassios Mavrokefalos graduated in Mechanical Engineering in 2002 from the University of Texas at Austin and received his M.Sc. and Ph.D in 2005 and 2008 respectively from the same school. He was a post-doctoral associate at the Massachusetts Institute of Technology until 2012 and he is currently an Assistant Professor at the University of Houston in the Mechanical Engineering Department. His research interests are in the areas of micro/nano scale heat transfer, thermoelectrics as well as solar/thermal electrical conversion systems.