Mechanical Engineering Department Seminar

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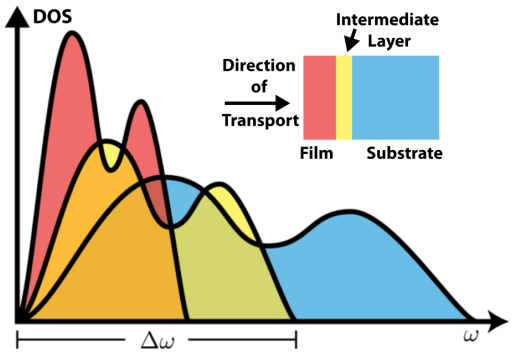
1130 Mechanical Engineering
111 Church Street SE, Minneapolis, MN 55455

Engineering Thermal Transport at Interfaces: Experimental and Computational Approaches

Pamela Norris

Executive Associate Dean of Research; School of Engineering and Applied Science, Mechanical Engineering and Aerospace Engineering – University of Virginia

From large-scale data centers to nano-sized transistors, thermal management plays a crucial role in device design and implementation. The effects of unoptimized thermal management, at both length scales, are clear: over half of the energy consumed by data centers is used only for cooling, and switching rates in computer processors are 300% slower today than 2005 projections. To improve these statistics, we must understand, at a fundamental level, the mechanisms which influence thermal transport, and learn to use this knowledge to modify the thermal properties with specific attention to the constraints of the intended applications. At the Nanoscale Energy Transport Laboratory at the University of Virginia, our research efforts combine both computational and experimental techniques to model, measure, and predict phonon dynamics, and the resulting thermal properties, for a wide range technologically relevant systems. In this talk, I will outline some of our capabilities and results, including non-equilibrium molecular dynamics (NEMD), non-equilibrium Green's Functions, wavelet analysis, and Time-Domain ThermoReflectance (TDTR), and review our recent work utilizing a combination of these approaches to study phonon transport in nano-scale systems.



Manipulating thermal boundary conductance by use of an intermediate layer serving as a "phonon bridge"

Bio: Pamela Norris is the Executive Associate Dean of Research in the School of Engineering and Applied Science and the Frederick Tracy Morse Professor of Mechanical and Aerospace Engineering at the University of Virginia. After receiving her PhD from Ga Tech and completing post-doctoral studies at UC Berkeley with Chang-Lin Tien, she joined the faculty at UVA in 1994. She is recognized as a leading expert in nanoscale heat transfer, especially interfacial thermal transport. She also holds patents for applications of aerogels in areas ranging from biological warfare detection, to lab-on-a-chip, to thermal insulation, along with patents for innovative thermal management techniques for jet-blast deflectors. She has served as the PI or Co-PI on over 45 sponsored research projects representing well over $25M from DOD, NSF, Industry and Foundations. She is well-known for her mentoring skills and for her dedication to increasing the representation and retention of women faculty in the STEM disciplines, serving now as the Director of UVA's NSF ADVANCE Institutional Transformation program.