

INSTITUTE OF TECHNOLOGY

presents the

The Donaldson Lecture Series - First Lecture

On interdisciplinary topics in Chemistry, Chemical Engineering Materials Science
and Mechanical Engineering

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Fluid and Thermal Transport in Nanostructured Materials & Devices

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402 Walter Library

In conjunction with the IGERT seminar series.

Abstract: The fundamental length scales related to flow of heat in solids and ions and molecules in liquids fall in the range of 1-100 nm. In the first part of my talk, I will focus on how confinement of aqueous solutions in the range of Debye screening length can lead to formation of unipolar ionic solutions. The ionic current in this regime is found to be extremely sensitive to surface charge, which can be used to study surface biomolecular reactions. Furthermore, this phenomenon can be exploited to develop nanofluidic transistors and integrated circuits, which is now forming the basis for analyzing complex mixtures of biomolecules in picoliter volumes. In the second part of the talk, I will focus on how phonons in solids can be manipulated in low-dimensional structures. In particular, I will report our effort in reducing thermal transport in crystalline solids below the alloy limit by carefully selecting nanostructures for spectrally broadband phonon scattering. This fundamental understanding is critical in the development of solid-state energy conversion devices, which could have impact in the way energy is utilized and converted.