東京大学 THE UNIVERSITY OF TOKYO

GMSI Graduate Program for Mechanical Systems Innovation

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Thermal Nanophotonics in Energy

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Date：Tuesday, May 28th, 2019, 9:30-10:30
Venue：31A, 3F Faculty of Engineering Bldg. 2

Abstract:

The fascinating nature of photonic nanomaterials has opened the door to novel approaches for conducting research in the field of energy conversion, storage and cooling technology. The ability to control thermal conductive and radiative properties of objects is of great interest in diverse areas like solar and thermophotovoltaic energy conversion, wavelength selective reflection and thermal emission/absorption, novel photon-based radiative cooling, and camouflage in military applications. Thermal transport of nanoengineered materials gets enhanced dramatically in comparison to their bulk counterparts. Thermal radiation at the nanometer scale is significantly different from classical or macroscopic radiative transport since near-field effects such as interference, diffraction, and tunneling of surface waves play a significant role.

Nanoscale thermal transport has shown great potential applications for use in manipulating macroscale energy systems and thermal/optical sensing. This talk will mainly focus on small-scale energy transport due to surface photon and/or phonon polaritons through the following research projects: (1) A dyadic Green's function formalism has been developed to determine the roles of nanoparticles in thermal radiative property; (2) Mie-resonance metamaterials have been studied and designed for wavelength selective thermal emitters/absorbers in order to increase energy conversion efficiency in solar energy harvesting; (3) Near-field enhanced thermal diodes and transistors have been investigated using phase-change periodic photonic metamaterials; (4) Metamaterials-based thermal biosensor has been proposed for ocean monitoring and early detection of cancer biomarkers; (5) Enhanced thermal conductivity of nanoparticle-nanofiber composites has been studied analytically and experimentally.

主催：
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