Harnessing thermal radiation at the nanoscale: Fundamentals and applications

Professor Jean-Jacques Greffet

Laboratoire Charles Fabry, Institut d'Optique
Université Paris-Saclay, CNRS
Palaiseau, France

Date:	3rd December 2025 (Wednesday)
Time:	4:30 p.m. – 5:30 p.m.
Venue:	LT1A, Cheng Yu Tong Building

Abstract

Thermal radiation is generally assumed to be both spatially and temporally incoherent. In this talk, we review advances in the last 30 years that challenge this idea when moving to the near field. It becomes possible to design incandescent sources which are directional and spectrally selective by taking advantage of surface waves. We also report the discovery of the enhancement by several orders of magnitude of the energy density close to an interface when surface phonon polaritons are excited. It follows that the radiative flux between two interfaces can be enhanced beyond σT^4.

This new insight into the science of thermal radiation enables new technologies for energy management. We will discuss applications to radiative cooling, thermophotovoltaic energy conversion, efficient IR sources and efficient light emitting metasurfaces. —fused magnesium furnace and achieved remarkable results in the reduction of carbon emission.

Biography

Professor Jean-Jacques Greffet is an alumni of Ecole Normale Supérieure de Cachan (1979-82). He obtained a PhD from university Paris-Sud Orsay in 1988 in solid state physics and the Habilitation in 1992. Jean-Jacques Greffet was a professor at Ecole Centrale Paris between 1994 and 2008. He is currently emeritus professor at Institut d'Optique, Université Paris-Saclay and an honorary member of Institut Universitaire de France. He has made a number of contributions in light scattering by random systems. Between 1994 and 2005, he worked on the theory of image formation in near-field optics. Since 1998, he revisited thermal radiation at the nanoscale. Some achievement include the demonstration of coherent thermal sources, theory of imaging of electromagnetic local density of states and enhanced heat transfer at the nanoscale due to surface phonon polaritons. Since 2005, he has explored quantum plasmonics and light-matter interaction at the nanoscale using plasmonic resonators and nanoantennas. He is currently working on light-emitting metasurfaces, both in the IR and visible. He is also developing new techniques to detect biological nanoparticles. He is a cofounder of the company Unveil. He has coauthored 225 refereed papers cited more than 23 000 times. He is a Fellow of Optica, he has received the Ixcore foundation prize and the Servant prize of the French Academy of Science.

Enquires: Prof. Jianbin Xu (jbxu@ee.cuhk.edu.hk)

Co-organized by

Department of Electronic Engineering

CUHK Electronic Engineering

REGISTER NOW