Thermal transport and heat management at small scales: *When fundamental meets engineering*

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Thermal transport at small length and short time scales is relevant to many industrial and technological processes. The recent development of nanotechnologies opens the way to control thermal transport at the nanoscale through material nanostructuration. New ideas and directions toward thermal engineering of nanomaterials and nanodevices may emerge from the meeting of different communities, nano and micro scale thermal transport, quantum transport, thermoelectricity and nanosciences.

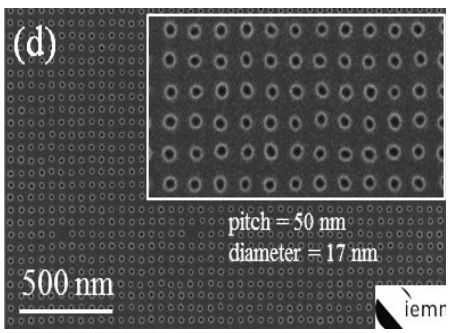
Thermal transport at small scales is basically dictated by the impact of system boundaries and interfaces on the transport properties of the energy carriers-photons, electrons or phonons. Compared to the classical laws ruled by macroscopic heat transfer and thermodynamics, new behaviors emerge at submicronic length scales: violation of Fourier's law, near field radiative heat transfer, interface thermal resistance. This paves the way for the design of functional materials having tailored thermal properties. Nanostructures may be also used for energy conversion applications including thermoelectric generator and for designing nonlinear devices such as thermal diode and thermal transistor. On the fundamental side, quantum thermodynamics has also recently emerged, targeting the description of nanosystems driven out of equilibirum, which would permit to define new strategies to control heat transfer in nanostructured materials.

The aim of this minicolloquium is to bring together experimentalists and theoreticians working on issues related to nanoscale thermal transport and management. This topic is clearly multidisciplinary and at the frontier between fundamental science and applied physics. The minicolloquium will be also a unique opportunity to attract people working in different communities namely, nano and micro scale thermal transport, quantum thermal transport, thermoelectricity, energy harvesting and mesoscopic physics.

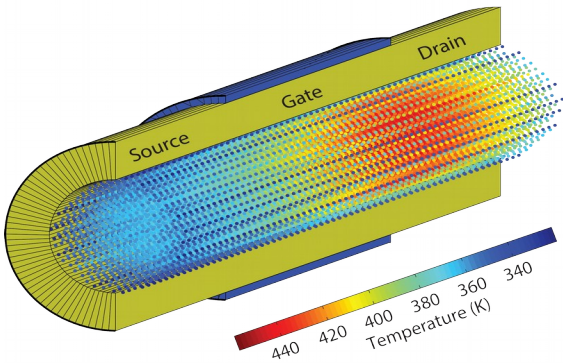
Keywords: phononics, nanostructured materials, radiative heat transfer, electronic transport, energy conversion and harvesting, thermoelectricity

Invited speakers

- Mathieu LUISIER, ETH Zürich, Switzerland
- Jean-François ROBILLARD, IEMN, Lille, France



Silicon phononic crystal membrane (from Jean-François Robillard)



Simulations: Self-heating of a nanowire (from Mathieu Luisier)