

RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM

Field: *Physics, Optics*

Subfield: Mechanical Engineering, Energy

Title: Controlling thermal emission

ParisTech School: Institut d'Optique Graduate School

Advisor(s) Name: Jean-Jacques GREFFET

Advisor(s) Email: jean-jacques.greffet@institutoptique.fr

Research group/Lab: Plasmonics/Laboratoire Charles Fabry

Lab location: Palaiseau, France

(Lab/Advisor website): <https://www.lcf.institutoptique.fr/groupe-de-recherche/nanophotonique/themes-de-recherche/plasmonique-et-nanophotonique-quantique>

Short description of possible research topics for a PhD:

Since the eighteenth century and the work of Kirchhoff, it has been taken for granted that thermal radiation is quasi isotropic and broadband, with a spectrum being characterized by the Planck function. In the last twenty years, with the advent of nanophotonics, the scientific community has learned how to control thermal emission. Directional and narrow band sources have been reported [1-3]. New research frontiers deal with the design of sources modulated at high frequency [4-5] or emitting circularly polarized light. The research topic consists in designing mid infrared thermal sources that can be modulated faster than 10 MHz and emitting circularly polarized light.

Required background of the student: Optics/Mechanical engineering (thermal radiation)

List of representative publications of the group:

1. Coherent emission of light by thermal sources, J.J. Greffet, R. Carminati, K. Joulain, J.P. Mulet, S. Mainguy and Y. Chen, *Nature* **416** p 61 (2002).
2. High efficiency quasi-monochromatic infra red emitter, G. Brucoli, P. Bouchon, R. Haidar, M. Besbes, H. Benisty, J.J. Greffet, *Appl.Phys.Lett.* **104**, 081101 (2014)
3. Plasmonic metasurface for directional and frequency-selective thermal emission, D Costantini, A. Lefebvre, A.L. Coutrot, I. Moldovan-Doyen, JP Hugonin, S. Boutami, F. Marquier, H. Benisty, JJ Greffet, *Phys. Rev. Applied* **4**, 014023 (2015)
4. Enhancing thermal radiation with nanoantennas to create infrared sources with high modulation rates, E. Sakat, L. Wojszzyk, J.P. Hugonin, M. Besbes, C. Sauvan, J.J. Greffet, *Optica* **5**, 175 (2018).
5. Light emission by nonequilibrium bodies: local Kirchhoff law, J.J. Greffet, P. Bouchon, G. Brucoli, F. Marquier, *Phys.Rev.X* **8**, 021008 (2018).