

OPTICAL THERMOTRONICS

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The control of electric current in solids is at the origin of modern electronics which has revolutionized our current life. A thermal analog for this technology which makes possible the same control for heat flux does not yet exist. However, over 60% of the energy used in industry is lost as low grade waste heat (temperatures less than 200°C). Harvesting, storing, transporting and converting this energy is today a challenging problem. Thermal flow management has therefore become a very important challenge due to limited energy resources and global warming issues.

Our objective in this PhD project is to develop the basic foundation for a “thermotronics” [1-3] dedicated to the control of heat flow carried by thermal photons both in near (subwavelength scale) and far-field (long distances) regimes.

This work will consist first in the development of metamaterials [4-5] able to rectify heat fluxes (the design of thermal diodes), to store the thermal energy (thermal memory) and to manipulate heat flux (thermal logical gate and thermal switch) in order to manage the radiative heat flux.

A master in physics or mechanical engineering with a solid background in the fields of electromagnetism and near-field optics is required. Knowledge of nanoscale heat transfers

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[2] P. Ben-Abdallah and S. A. Biehs, Appl. Phys. Lett. **103**, 191907 (2013) .

[3] V. Kubytskyi, S.-A. Biehs, and P. Ben-Abdallah, Phys. Rev. Lett. **113**, 074301 (2014) selected as PRL Editor's suggestion and Focus Physics **7**, 85 (2014)

[4] D. Felbacq, G. Bouchitté, Phys. Rev. Lett. 94, 183902 (2005).

[5] D. Felbacq, G. Bouchitté, SIAM J. Appl. Math. 66, 2061-2084 (2006).