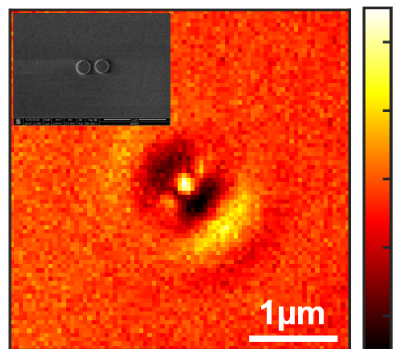


**RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM****Field:** *Physics, Optics***Subfield:** Applied Physics**Title:** Nanostructures fabrication and characterization for implementation in optoelectronic devices**ParisTech School:** ESPCI Paris | PSL**Advisor(s) Name:** Lionel Aigouy / Zhuoying Chen**Advisor(s) Email:** [lionel.aigouy@espci.fr](mailto:lionel.aigouy@espci.fr) / [zhuoying.chen@espci.fr](mailto:zhuoying.chen@espci.fr)**Research group/Lab:** MNC Group / LPEM**Lab location:** ESPCI**(Lab/Advisor website):** <https://www.lpem.espci.fr>**Short description of possible research topics for a PhD:**

Optoelectronic devices such as solar cells, photodetectors constantly need to be improved and optimized in terms of sensitivity and detection range. For that, conventional, 'flat', devices are often associated to nanostructures whose presence change the local optical, electronic, or thermal properties of the devices and lead to better performances. Nano-antenna, meta-surfaces, plasmonic or dielectric nanostructures can be used but the visualization of their



effect at the sub-micron scale is necessary for a fundamental comprehension and final device optimization. As seen in the figure, the near-field around two adjacent plasmonic nanodisks exhibit a strong increase in their gap which can lead to better absorption and a local temperature increase. The goal of this thesis is to design and study plasmonic and dielectric nanostructures with particular local properties able to modify and improve the characteristics of a real device like a solar cell, a photodetector, or a photothermo-electric detector. The local optical and thermal properties will be correlated to the device tested in operation, so that a direct optimization will be made.

**Required background of the student:** master degree in Chemistry, Physics, Materials Science.**A list of 5 (max.) representative publications of the group:**

- 'Mapping plasmon-enhanced upconversion fluorescence of Er/Yb-doped nanocrystals near gold nanodisks.', L. Aigouy, M.-U. González, H.-J. Lin, M. Schoenauer-Sebag, L. Billot, P. Gredin, M. Mortier, Z. Chen and A. García-Martín. *Nanoscale* 11, 10365-10371 (2019)
- 'TiO<sub>2</sub> nanocolumn arrays for more efficient and stable perovskite solar cells.', Z. Hu, J.-M. García-Martín, Y. Li, L. Billot, B. Sun, F. Fresno, A. García-Martín, M.-U. González, L. Aigouy, Z. Chen. *ACS Applied Materials & Interfaces* 12(5), 5979-5989 (2020).
- 'Exploring the Magnetic and Electric Side of Light through Plasmonic Nanocavities.', C. Ernandes, H.-J. Lin, M. Mortier, P. Gredin, M. Mivelle, and L. Aigouy. *Nano Letters* 18 (8), 5098-5103 (2018)