2024-2025

Master thesis proposal

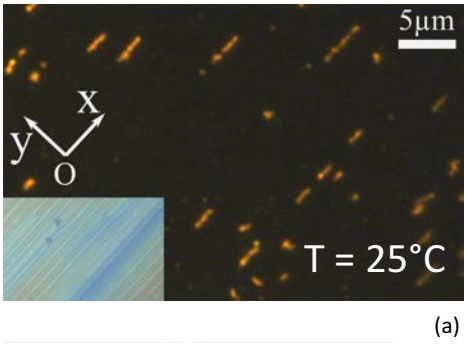
Campus Pierre et Marie Curie
Tower 23 – 3rd floor – 23-22
Director: Massimiliano Marangolo

Title: **Temperature-controlled plasmonic nano-antennas**

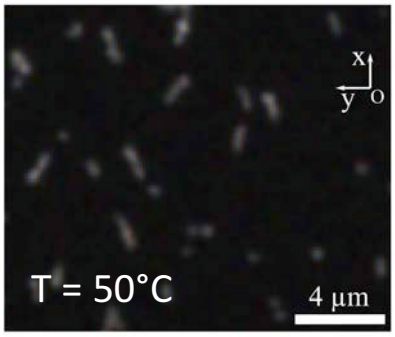
Keywords: nanoparticles, assembly, spectrophotometry, plasmonic cavities

Scientific description:

Already around 15 years ago, it has been shown that liquid crystal topological defects can be used to confine and organize nanoparticles. In particular, oriented chains of nanospheres or of tip-to-tip nanorods have been formed in unidimensional smectic defects, dislocations and disclinations [1]. The liquid crystal phase transitions occurring at low temperature, liquid crystals can provide temperature-activated assemblies of nanoparticles (Fig.1) [2]. In this context, we propose to use oriented unidimensional smectic defects in order to build plasmonic nanoantennas based on strictly facing gold nanorods in close contact. We will study the evolution of the light absorption of the nanoantennas when temperature is increased in relation with the disappearing of the liquid crystal defects driven by the liquid crystal phase transition. This study will pave the way for an activation of the coupling strength between nanoparticles actively tuned by the temperature. This would be a first step towards future optical devices based on visual appearance controlled by varying temperature.



(a)



(b)

Figure 1 : Assembly of fluorescent nanoparticles confined and oriented within the defects of a smectic liquid crystal at 25°C (a), disoriented in absence of defects at 50°C, in isotropic phase (b)

[1] S.P. Do et al. Nano Letters 20 (2020) 1598, [2] H. Jeridi, Appl. Phys. Lett. 123 (2023) 203101

Techniques/methods in use: Optical Microscopy, spectroscopy
Applicant skills: no specific skills
Industrial partnership: N

Internship supervisor(s) (name, email, phone, webmail): Emmanuelle Lacaze, emmanuelle.lacaze@insp.jussieu.fr, 0633899049
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Possibility for a Doctoral thesis: Y, already financed by ANR