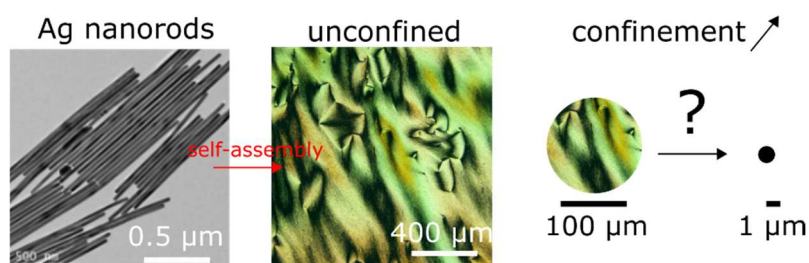


Confinement of Plasmonic Liquid Crystals in Emulsion Droplets

Plasmonic nanoparticles can self-assemble into liquid-crystalline phases with collective optical properties that differ strongly from those of isolated particles.¹ This project will investigate the confinement of these new phases within emulsion droplets to create microscale, reconfigurable plasmonic materials. The study will focus on gold and silver nanorods forming nematic and smectic phases in confined geometries. It is expected that the curvature of the droplet interface impose specific orientations and generate defects or frustrated configurations. The project will establish robust protocols for producing water in oil droplets containing plasmonic liquid crystals.

The influence of droplet size, nanoparticle concentration and surface chemistry on the confined structures will then be investigated. The project will combine nanoparticle synthesis, self-assembly and optical/structural characterization. Polarized optical microscopy will be used to visualize the orientation of the liquid-crystalline domains. UV-Vis spectroscopy will probe the coupling between nanoparticle plasmons and the collective organization of the particles. Small-angle X-ray scattering will provide quantitative information on interparticle distances and orientational order. Particular attention will be given to the formation and stabilization of topological defects under spherical confinement. External stimuli, including electric fields, temperature and light, will be explored to control the confined structures. The resulting optical response will be correlated with the internal organization of the nanoparticles. The droplets will therefore act as individual plasmonic pixels whose optical properties can be dynamically modified. Different droplet sizes and confinement conditions could provide access to distinct metastable configurations. The work will establish how confinement can be used as a control parameter for plasmonic self-assembly. Beyond fundamental studies, the approach could provide a scalable route toward reconfigurable optical materials and micrometre-sized plasmonic devices. Ultimately, the project aims to develop confined plasmonic liquid crystals with controllable structure, defects and optical response.

Environment. This internship will be supervised by C. Hamon (CNRS researcher) and Marianne Imperor-Clerc (CNRS researcher) at the Laboratoire de Physique des Solides (LPS). The internship duration is extensible up to 6 months. Possibility to continue this work in PhD (ANR funding or PhD scholarship). Students with a taste for interdisciplinary research (colloidal synthesis, self-assembly, use of advanced characterization tools and eventually on synchrotron sources) are encouraged to apply. Contact: cyrille.hamon@universite-paris-saclay.fr. For more information, you can consult this webpage: <https://metamat.eu/>



(1) Kutalia, N.; Trazo, J. G.; Marchand, S.; Goldmann, C.; Ratel-Ramond, N.; Dozov, I.; Bizien, T.; Constantin, D.; Imp  rator-Clerc, M.; Davidson, P.; Hamon, C.. Plasmonic nanorods form reconfigurable liquid crystalline assemblies. *ChemRxiv* **2026**, 2026 (0521). DOI: doi:10.26434/chemrxiv.15003689/v1.