FINAL MASTER PROJECT PROPOSAL

Title

Elaboration and study of 2D nanoparticle assemblies by Langmuir-Blodgett

Supervisor(s)

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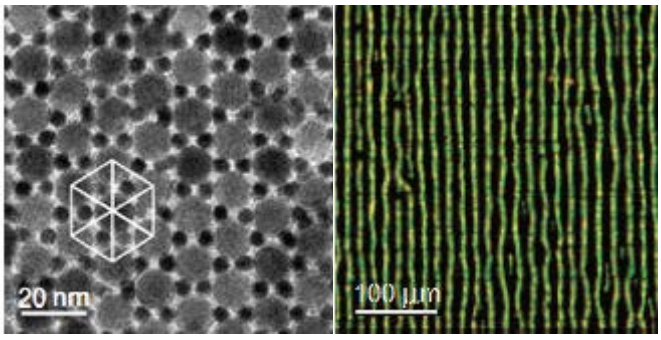
Summary of the project

Nanoparticles arrangements are emerging as key platforms for applications in light–matter interactions, quantum technologies, magnetism, and biotechnologies. The objective of controlling particle disposition to form defined structures has triggered the development of various techniques. Recently, Langmuir–Blodgett has been proved to be a successful approach producing two-dimensional (2D) structures of novel plasmonic materials. The aim of this proposal is to fabricate 2D assemblies of magnetic nanoparticles (MPNs) by Langmuir–Blodgett (or Langmuir-Schaeffer) method(s) with control of the geometry of the arrangement.

Different strategies will be followed to produce (i) chains of MNPs and (ii) assemblies of different geometrical shapes. In particular, we will focus on (a) control of the MNPs structures at the air/subphase interface with subsequent transfer on a substrate by horizontal dipping and (b) structuration of the MPNs by the substrate, either controlling the contact line between the substrate and the liquid interface, or using functionalized and/or templated substrates.

MNPs with different capping, commercially acquired, will be transferred to an appropriate solvent. In some experiments, substrate will be functionalized to address the specific deposition of MNPs. Structures will be characterized by Atomic Force Microscopy, Scanning Electron Microscopy, and Transmission Electron Microscopy. Their magnetic properties will be analyzed by Magnetic Force Microscopy and Magneto Optic Kerr Effect. This is an interdisciplinary work that requires two supervisors: Dr. Gascón for the preparation of structures and Dr. Urtizberea for the study of their structural and magnetic properties.



Left: TEM image of an assembly from 13 nm and 4 nm NPs.
Right: Microscopy images of NPs stripe pattern formed by vertical deposition.