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The Institute  
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Sciences



## **Master in Photonics – “PHOTONICS BCN” Master ERASMUS+ “EuroPhotonics”**

### **MASTER THESIS PROPOSAL**

**Dates: April 2020 - September 2021**

**Laboratory: Institute of Materials Science of Barcelona  
Institution: CSIC  
City, Country: Barcelona, Spain**

**Title of the master thesis: Building Plasmonic Crystals from Plasmonic Metamolecules**

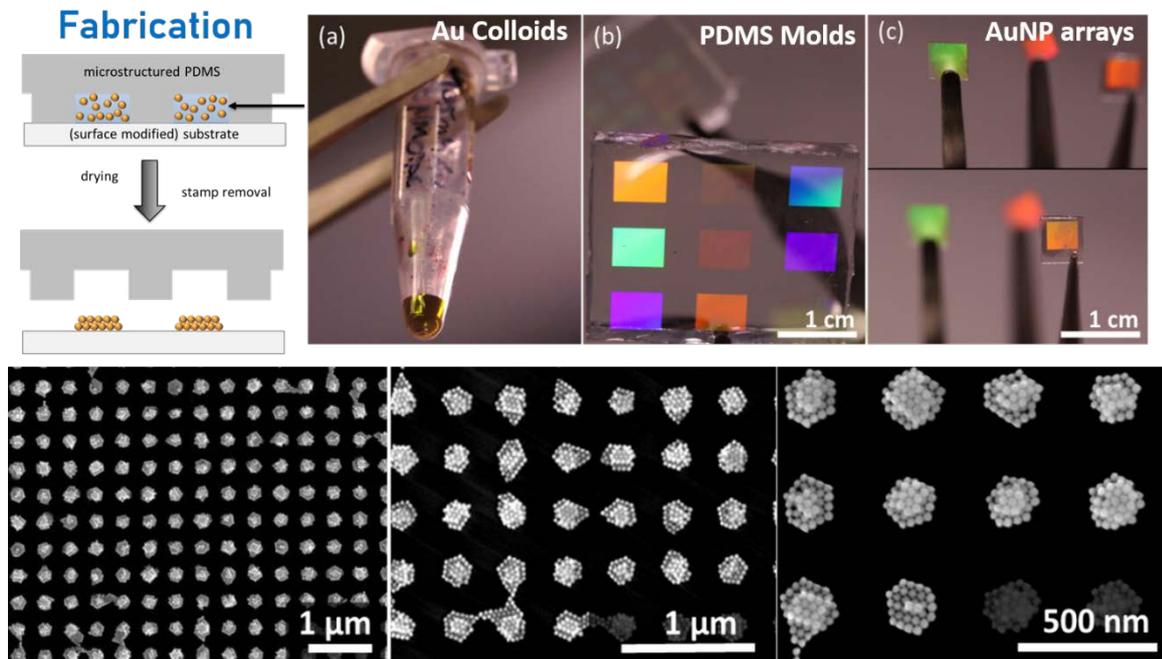
**Name of the master thesis supervisor and co-supervisor: Agustín Mihi**  
(for external proposals a co-supervisor from the program is needed)

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**Keywords: Plasmonics, Sensing, Self-Assembly, colloidal nanoparticles**

#### **Summary of the subject (maximum 1 page):**

Metal nanoparticles sustain localized plasmon resonances upon light irradiation that depend on the material and their size and shape. If several of these particles are placed together, the optical properties of the colloid are modified by the arrangement of the metamolecule. By periodically organizing these plasmonic metamolecules into a lattice we obtain a plasmonic crystal exhibiting a tuneable optical response tailored to match the intended application. Plasmonic crystals show strong near fields that have shown a great potential for sensing (*ACS Nano* 2018, 12, 8, 8531–8539), but the overall plasmonic crystal structure has many more properties to unveil for light management. In our group, we have developed a technique to assemble plasmonic crystals within minutes with excellent optical response over VIS and NIR regions and over large areas appealing to optoelectronic integration. In this master project, we propose the study of plasmonic crystals for enhanced light emission and the exploration of different pathways to obtain chirality in these architectures, and exciting emerging topic.  
*Contact us to know more!*



**Figure 1.** Plasmonic crystals are readily fabricated within minutes without requiring complex lithographies. (a-c) Show the colloidal Au inks employed, the stamps used for the assembly and the resulting structures. The bottom images correspond to different magnification SEM of the crystals.

This research field entails a mixture of disciplines such as plasmonics, chemistry, optical characterization, theoretical modelling and engineering. Many backgrounds are welcome to join this interdisciplinary topic.

In particular you will learn to engineer your plasmonic structure, to fabricate it and to fully characterize it using optical and structural characterization methods, including UV-vis, optical microscopy, dark-field spectroscopy, circular dichroism and electron microscopy (both transmission and scanning).

#### Additional information :

\* Required skills: we search for a highly motivated and enthusiastic researcher. Previous experience in plasmonics will be highly valued. All the main communication will be held in English (a level B2 in written and spoken English is desired)

\* Miscellaneous : The NANOPTO group is composed of a multidisciplinary team of physicists, chemists and engineers. The candidate will join a family of international researcher, a rewarding and motivating work environment, with the main goal of enjoying the discovery process that thrust scientific innovation.

website: <https://enlightment.icmab.es/>

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