



"la Caixa" INPhINIT PhD fellowship expression of interest

Few-atom metal nanocluster lasers

About the Project

Metal nanoclusters (MNCs) composed of few metal atoms with sizes below 2 nm **are fascinating structures with outstanding optical properties**. Unlike plasmonic nanoparticles (of > 2nm size), MNCs exhibit a molecular-like electronic structure with discrete levels arising from strong quantum confinement which are optically-coupled. Thus, MNCs can be exploited in a range of applications spanning from light emission in solid state devices, solar energy harvesting, photocatalysis or bioimaging. MNCs based on noble metals like Au offer the advantage of being biocompatible, paving the way for potential health-related applications including in vivo imaging of tissue or photodynamic therapies. Furthermore, the MNC synthesis is relatively simple and can rely on relatively abundant elements (like Cu for instance), becoming **highly sustainable luminescent materials** with photoluminescent quantum yields up to 40-60%. In this project we will investigate the use of MNCs as front-runners to substitute conventional LED and laser materials. In particular the development of lasers based on few atom MNCs has not been demonstrated yet and it would constitute an important milestone in the field of Optoelectronics.

What we offer: a PhD position in our group working on the "Few-atom metal nanocluster lasers" project. The PhD program will involve the use of the following techniques:

- Femtosecond transient absorption spectroscopy. This cutting-edge technique will enable to establish a relation between MNC composition and electron relaxation processes.
- Photoluminescence spectroscopy. The emission properties of MNCs will be characterized together with assessment of stimulated emission in MNCs suspended in solution or dispersed in thin films.
- Nanopatterning techniques. The candidate will develop photonic structures with state-of-the-art nanofabrication techniques to pursue solid-state laser resonators.
- A range of complementary techniques such as Raman spectroscopy, optical and electron microscopy or atomic force microscopy available at IMDEA are expected to be used.

The candidate will be integrated in a friendly and motivated research team, having the possibility to acquire skills on a broad range of techniques for materials inspection, publish his work on highly reputed scientific journals and disseminate the acquired knowledge in international events around the world.

What we require: we look for highly motivated candidates with a background in physics, chemistry or related engineering who are willing to work in a dynamic team. Knowledge in the field of optics will be appreciated. Computer skills and software programming in Labview, Python or C++ will also be of interest but not mandatory.

<https://www.nanociencia.imdea.org/organic-photophysics-and-photonics/group-home>

How to apply

This is a competitive fellowship opportunity, funded through ["la Caixa" INPhINIT programme](#). Interested candidates should get in contact (juan.cabanillas@imdea.org) for an informal discussion about the project and how we can support your application.

About IMDEA Nanociencia

[IMDEA Nanociencia](#) is an interdisciplinary research centre dedicated to the exploration of basic nanoscience and the development of applications of nanotechnology in connection with innovative industries. Our purpose-built building was inaugurated in 2014 and the institute has since been consecutively awarded with the highest national recognition of scientific excellence and international impact. The institute has a high scientific output >2,000 indexed publications (~200 per year, >80% in Q1 journals) and counts with state-of-the-art facilities in over 40 operative laboratories.

We are located at the UAM-CSIC Cantoblanco Campus, a highly competitive world-class research environment with access to facilities from the Universidad Autónoma de Madrid (UAM), several Spanish Scientific Research Council (CSIC) centres and Madrid Science Park. The Cantoblanco Campus is just a few minutes away from Madrid's lively city centre, connected by "cercanías" trains and several bus lines.

IMDEA Nanociencia hosts over 200 scientists in a true international and inclusive environment, who tackle complex multidisciplinary problems through scientific excellence and best practice. We are fully committed to equality and diversity in the workplace and we encourage applications from all candidates irrespective of their background.