PhD POSITION IN
DESIGN AND CONTROL OF SINGLE MOLECULE CIRCUITS

Molecular electronics studies electron transport phenomena through individual molecules. Its basic subject of study is a **molecular junction**, an electric circuit formed by a single or few organic molecules which are bound between two atomically sharp metallic electrodes. On the bases of these junctions, the field has been successful in reproducing a number of basic operations of electronic circuit components, such as wires, transistors, or switches. These accomplishments bare the promise of maximal circuit miniaturization and the possibility of scalability. In addition, molecular junctions are an ideal framework for the study of the fundamental underlying principles governing electron transport in organic materials at the minimal level of an individual molecule, including non-trivial quantum effects at room temperature.

Through the **Europe-Japan collaborative project DECOSMOL**, the *Molecular Electronics Laboratory* at IMDEA Nanociencia (Madrid) and the *Organometallic Chemistry and Molecular Electronics* at Universidad de Granada are looking for a shared PhD Student to work on the study of the electrical properties of individual molecular entities as core of future technologies such as Spintronics, 2D Materials or Bioelectronics. In this project, the student will work in a combination of techniques going from molecular synthesis to electron transport characterization. The student will use a homemade Scanning Tunnelling Microscopy recently equipped with electrochemical control and thermal monitoring, that has allowed gain rich knowledge on the importance of molecular bond, molecular conformation, add-atoms, and molecular bridge among others factors on the electrical characteristics[1,2,3,4]. The student will explore the spin-dependent transport in single molecules, working with magnetic polarized electrodes.

In this project, the student will benefit from an **international framework** which includes top research teams expert in synthetic synthesis, electrical properties, optical spectroscopies and theoretical atomistic simulations from Spain, Japan and Czech Republic. Short stays within the consortium are envisaged.

Requirements:

An ideal candidate would have a background in Chemistry, Physics or Engineering and hold a MSC degree in Nanotechnology (or equivalent). However, a strongly motivated candidate who lacks any of the above will also be given a serious consideration. Moreover, it is expected that the successful candidate will be independent, creative, curiosity-driven, motivated to explore solutions to difficult scientific problems, and have strong work ethics. Good academic credentials and good knowledge of English will be a plus.

[1] Miguel, D. et al. Toward Multiple Conductance Pathways with Heterocycle-Based Oligo(phenyleneethynylene) Derivatives. J. Am. Chem. Soc. 2015, jacs. 5b05637.
[2] Leary, E. et al. Incorporating single molecules into electrical circuits. The role of the chemical anchoring group. Chem. Soc. Rev. 2015, 44 (4), 920.
[3] Casares R. et al. Engineering the HOMO–LUMO gap of indeno[1,2-b]fluoreneJ. Mater. Chem. C, 2022, 10, 11775–11782
[4] Ortuño A. M. et al. Chiral Single-Molecule Potentiometers Based on Stapled ortho-Oligo(phenylene)ethynylenes Angew. Chem. Int. Ed. 2023, e202218640

Contact researchers:

Dr. M. Teresa González: teresa.gonzalez@imdea.org

Dr. Juan Manuel Cuerva: jmcuerva@ugr.es