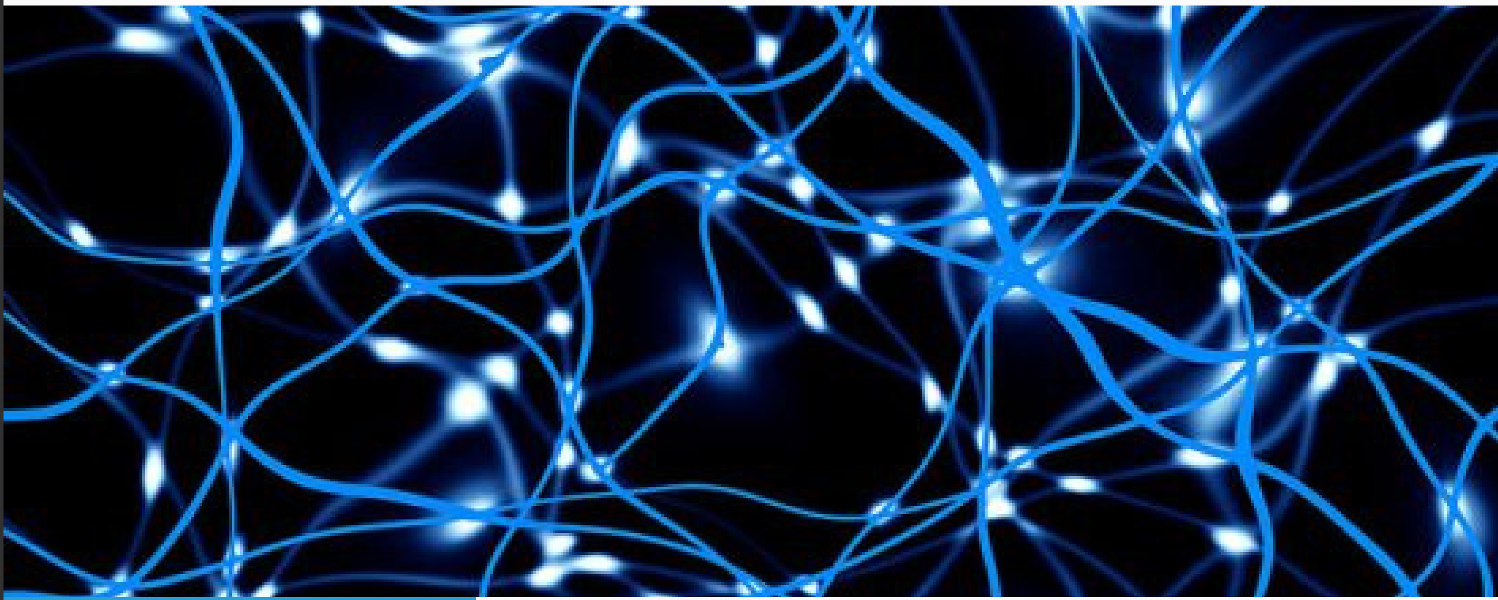
JOB POSITION

MEMRISTIVE DEVICES BASED ON MOLECULAR MATERIALS



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In a conventional computer architecture, two separated elements are fundamental: the processing and the memory units. However, most of the leading computer applications, such as pattern recognition and data mining, clearly show a huge inefficiency arising from that separation. This is known as von Neumann bottleneck.

One optimum strategy to overcome this problem is to mimic the biological neurons, which are the most efficient computing elements in nature. Thus, there exists a huge effort to build Artificial Neural Networks which imitate the behavior of neurons by using electronic components. For this hardware-based neuromorphic computing, a key microelectronic element is the memristor, which varies non-linearly its resistance according to the previous history of voltage applied to it.

Memristors are the most suitable components for energy-efficient neurohardware applications as they can combine information processing with memory storage in a single component, just like neurons.

Objectives of this project

The DRIVING IDEA of this project is to offer design criteria to obtain new molecular memristive materials with key improvements in terms of energy requirements, tunability, size, fabrication and processability by using molecular models and dimensionality control.

Job description

This PhD position will be devoted to the experimental fabrication and characterization of molecular memristive devices. This will be complemented with a parallel theoretical effort beyond drift-diffusion equations. From a MATERIAL SCIENCE PERSPECTIVE, understanding and probing the mechanisms that govern memristive behavior in molecules is mandatory to design and build robust and energy efficient Memristive Materials. This will contribute to solve a critical challenge in current computing industry.

The main objective of this PhD will be to unravel the fundaments of ionic transport in molecule-based materials. In particular our model material will be formed by an ionic salt embedded in a molecular semiconducting matrix. As the voltage is applied, most of the mobile ions will be displaced to the electrode interfaces thus creating a decrease in the injection barrier and modulating the electric current in function of the bias voltage. Here we aim to understand the ion migration phenomenon under the effect of a time-dependent external electric field. This necessary task has been only slightly studied with effective equations up to now, thus the novelty of our study represents a major change in the state-of-the-art of the current devices based on this mechanism.

Qualification

The applicant should hold a degree in Physics, Chemistry, Engineering or Materials Science with excellent qualifications (honors degree preferable for international students). Research experience will be considered favourably. The call is open for all nationalities.

Work environment

ICMol is an attractive destination for top talent PhD students. It currently hosts 8 ERC grantees at different stages of theircareers (Advanced, Consolidator and Starting) and Marie Curie Fellows, andsince 2016 has been awarded the seal of excellence “Maria de Maeztu” by the Spanish Government, which recognises top research institutions in Spain.