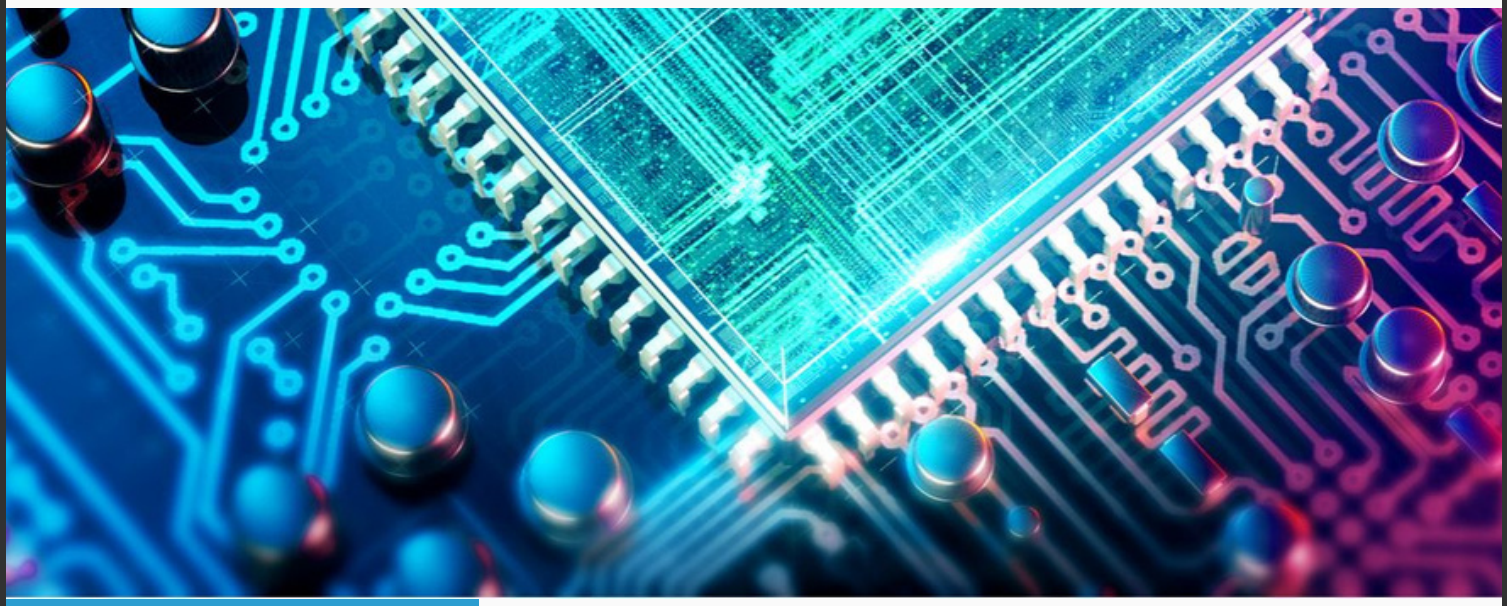
VNIVERSITAT DE VALÈNCIA

ICMOL Instituto de Ciencia Molecular

JOB POSITION

MOLECULAR SPINS FOR QUANTUM COMPUTING



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Project supervisor.
RTMM group

Quantum technologies exploit the quantum behavior of matter to achieve novel functionalities. A novel paradigm within this field is the molecular spin quantum processor. Artificial magnetic molecules can embody multiple addressable quantum spin states, and these states can be controlled, read-out and linked via their coherent coupling to on-chip superconducting circuits.

This scheme integrates quantum functionalities at three different scales (nuclear spins, electronic spins and circuits), is inherently modular and therefore scalable, and is also very flexible. Current open problems include the chemical design of molecules which (a) present the required internal structure, in terms of quantum information, e.g. a fast processing subunit presenting an adequate communication channel with a protected memory subunit (b) are able to protect quantum information for a sufficiently long “coherence” time and (c) can be strongly coupled to the external (macroscopic) device in order to scale the system to a large number of qubits.

INPhINIT "la Caixa" Fellowship Programme

Objectives of this project

Design, characterization and modeling of magnetic molecules that can be useful in the design of a quantum spin processor. First, a selection of magnetic molecules that have already demonstrated potential as molecular spin qubits will be identified in terms of their quantum spin dynamics. Second, theoretical models will be developed to rationalize their behaviors and to allow to design the next generation of molecular spin qubits. Third, the novel batch of molecules will be positioned with nanometric accuracy on specific positions of the superconducting circuits using nanopatterning tools. Finally, the behavior of the quantum device will be characterized, rationalized and optimized by combining experimental and theoretical efforts.

Job description

To develop this project an integrative and multidisciplinary approach is proposed in which quantum theory and computational tools will be combined with physics, materials science and nanotechnology .

Training

The PhD candidate will receive a strong theoretical training in quantum and solid state physics, complemented by an interdisciplinary training in materials science and device fabrication (including working in clean conditions and at cryogenic temperatures). The candidate will also develop transferable skills such as excellent oral and written communication skills, time management, team work and project planning & management.

The PhD will be integrated in a multidisciplinary group leaded by Prof. E. Coronado in which he/she will have access to all the theoretical and experimental facilities required to perform the proposed project. He/she will be supervised by Dr. Alejandro Gaita Ariño, who leads the theoretical part of the group. This project will be developed in the frame of the European Project FATMOLS (H2020 Grant Agreement 862893).

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.