Marie-Skłodowska-Curie Actions – Individual Fellowships 2020

ICN2 Expression of Interest

Group leader:

Aitor Mugarza

Scientist in charge of the fellow:

Aitor Mugarza

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Brief description of the research group:

Our research is focused on the atomic-scale engineering of the quantum properties of novel nanomaterials. At the nanoscale, the properties of materials are dominated by quantum effects and interfacial phenomena, which impose strong limitations on the control and reproducibility of device performances, but also open up avenues for engineering new physical properties. The aim of our group is to understand and control quantum phenomena with atomic precision by chemical and structural manipulation, nanostructuring and interfacing materials that are identified as strategic in the roadmap for new technologies (hybrid metal-organic heterostructures, graphene-based 2D materials, topological insulators...).

Our methodology is based on the in-situ synthesis and characterization in ultra-high vacuum conditions, combining scanning probe microscopy (STM) with electron (XPS/ARPES) and photon (XAS/XMCD) spectroscopies.

We are also exploring different optoelectronic and sensing device concepts with the materials we synthesize.

Title of project:

Magnetic 2D metal-organic frameworks

Project description:

2D metal-organic frameworks (MOFs) constitute a new class of designer materials where the coexistence of Dirac electrons and flat bands can lead to the realization of ferromagnetism and other more exotic quantum phases such as topological and quantum anomalous Hall insulators.

This project aims at exploring emerging magnetic and topological phenomena in novel 2D MOFs. These will be synthesized following coordination chemistry, based on the surface-

assisted self-assembly of the metal and organic components. The intrinsic properties of the 2D MOFs will be explored by synthesizing them on weakly interacting metals. In a second step, 2D MOFs will be interfaced with inorganic topological insulators with the aim of tailoring electronic and magnetic interactions between the two materials (see "Molecular Approach for Engineering Interfacial Interactions in Magnetic/ Topological Insulator Heterostructures", M. Gonzalez et al. ACS Nano, just accepted, https://doi.org/10.1021/acsnano.0c02498).

The candidate will synthesize the nanomaterials in ultra-high vacuum conditions and characterized them by combining scanning tunnelling microscopy and spectroscopy (STM/STS), X-ray and angle-resolved photoelectron spectroscopy (XPS/ARPES), and X-ray absorption spectroscopy and magnetic circular dichroism (XAS/XMCD).

Research area:

Chemistry	CHE	x
Social Sciences and Humanities	SOC	
Economic Sciences	ECO	
Information Science and Engineering	ENG	
Environmental Sciences and Geology	ENV	
Life Sciences	LIF	
Mathematics	MAT	
Physics	PHY	x

ICN2 HR will request a letter of motivation, CV (max. 4 pages) and two referees.