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:

Ferromagnetic vdW heterostructures

Project description:

Spin-valleytronics, which aims at utilizing the coupling of spin and valley degrees of freedom for information processing, could lead to a new generation of ICT devices. Progress in the field of spin-valleytronics is currently hampered by a limited choice of materials that exhibit both spin and valley characters. Instead of relying solely on the dual character of individual materials, one may alternatively exploit the possibility of

fabricating a van der Waals (vdW) heterostructure that incorporates two kinds of layered materials, each displaying either spin or valley character.

For the realization of vdW heterostructures, a missing ingredient to date is ferromagnetic layered materials. In response to the above problems, this proposal will focus on the following:

• Realizing ferromagnetism by three distinctly different non-destructive strategies: (1) transition-metal doping, (2) direct growth of heterostructures with intrinsic magnetic properties, and (3) interfacial magnetic proximity effect.

• Performing all in-situ growth and characterization of ferromagnetic vdW heterostructures combining STM, XPS, ARPES, and XMCD. Magnetic characterization will be complemented with ex-situ ferromagnetic resonance and magnetotransport.

This proposal is for a Global Fellowship, and will consist on a 2 year outgoing phase in the group of Prof. Andrew Wee at the National University of Singapore (NUS), followed by a one year return phase in the group of Prof. Aitor Mugarza at the Catalan Institute of Nanoscience and Nanotechnology (ICN2).

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.