

Large scale facilities and magnetism: x-rays and neutrons to probe bulk and patterned magnetic nanomaterials

J.M. Porro

BCMaterials, Basque Center for Materials, Applications and Nanostructures, 48940 Leioa, Spain

Ikerbasque, Basque Foundation for Science, 48013 Bilbao, Spain



One of the key aspects for the development of new materials relies on the ability to profoundly study their fundamental properties. The usage of neutron and synchrotron radiation sources provides scientists with unique tools to probe matter in a wide range of length and timescales, accessing to both the structure and time-resolved dynamics of the materials issue of study. In this talk, an introduction to different neutron and synchrotron radiation scattering techniques will be presented, together with some specific science cases related to magnetism and magnetic materials studied with these techniques. More concretely, the following techniques and science cases will be presented:

1. X-Ray Photon Correlation Spectroscopy to study the magnetization dynamics of artificial spin ices.
2. Transmission X-Ray Microscopy to study the propagation of magnetic charges in artificial spin ices.
3. Powder Neutron Diffraction to study the origin of magnetism in Heusler-type Magnetic Shape Memory Alloys.
4. A combination of Single Crystal Neutron Diffraction and X-Ray Magnetic Circular Dichroism to study the magnetism in high temperature Magnetic Shape Memory Alloys.

A brief introduction to the field of artificial spin ices and to Heusler-type magnetic shape memory alloys will also be presented.

[1] S. A. Morley, D. A. Venero, J. M. Porro *et al.*, *Phys. Rev. B* 95, 104422, 2017

[2] J. M. Porro, S. A. Morley *et al.*, *Sci. Rep.* 9, 19967, 2019

[3] S. A. Morley, J. M. Porro *et al.*, *Sci. Rep.* 9, 15989, 2019

[4] A. Pérez-Checa, J. M. Porro *et al.*, *Acta Materialia* 196, 549-555, 2020

Short Bio

Physics PhD in Materials Science, from the University of the Basque Country (2014), under the supervision of the Ikerbasque Research Professor Paolo Vavassori, nanomagnetism group co-leader at CIC nanoGUNE in Donostia-San Sebastián, Basque Country, Spain. Post-doctoral experience as a research associate for 3.5 years at the Large Scale Structures group of the ISIS neutron and muon source of the Rutherford Appleton Laboratory, STFC, UK. Visiting scientist for three years at the I10 beamline of the Diamond Light Source, the synchrotron facility of the United Kingdom. In 2017 he secured a Marie Skłodowska-Curie Individual Fellow at BCMaterials, the Basque Centre for Materials, Applications and Nanostructures of the Basque Country (Spain). Currently he holds an Ikerbasque Research Fellow position at BCMaterials. He has research experience in U.S. National laboratories such as the Lawrence-Berkeley National Laboratory and the Brookhaven National Laboratory. He has also carried out research stays at the Kernfysisch Versneller Instituut of the University of Groningen, the Netherlands, and at the Nanotechnology Core Facility of the University of Illinois in Chicago, United States. His expertise focuses on nanomagnetism, with hands-on experience in the design and manufacture of patterned micro and nanostructures, as well as in the field of Magnetic Shape Memory Alloys. He has extensive experience in the use of large facilities, such as neutron and synchrotron radiation sources. He is a member of the Editorial Board of the journal *Magnetochemistry* (IF: 2.193); of the Magnetic Materials Committee of the Functional Materials Division of the TMS (The Minerals, Metals and Materials Society), USA; and of the User Committee of the Russian neutron source IBR-2 (Dubna, Russia).