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10:00 h
Aula, Edificio I+D
Campus Río Ebro

Intra-particle spin disorder: Key player in the heat generation

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About the speaker: Elizabeth Martín Jefremovas (Santander, 1994) is a postdoctoral researcher at the Nanomag group, University of Luxembourg. She earned her PhD “Spin dynamics in magnetic nanoparticles” in 2021 at the University of Cantabria, Spain, under the supervision of Prof. Dr. Luis Fernández Barquín. She was awarded an Alexander von Humboldt postdoctoral fellowship to develop a project, “3D-SKY”, aiming to study three-dimensional spin textures in 2D materials, joining the groups of Prof. Dr. Jairo Sinova and Prof. Dr. Mathias Kläui at the Johannes Gutenberg University Mainz, Germany from 2022-2024. In August 2024, she joined the group of Prof. Dr. Andreas Michels at the University of Luxembourg with a Marie-Curie-Young International Academics postdoctoral fellowship to elucidate the paradigm of spin disorder in magnetic nanoparticles with focus on biomedical applications.

Abstract: In recent years, the field of nanomagnetism has benefited from magnetic defects to expand the limits of knowledge and applications. However, in nanoparticles, the full potential of spin disorder is yet to be fully unlocked. In this talk, I will present key results from my current MSCA-YIA project, named HYPUSH, which aims to harness intra-particle magnetic inhomogeneities for pushing the therapeutic efficiency of magnetic hyperthermia. With a strong emphasis on micromagnetic calculations, HYPUSH combines real-space calculations with small-angle neutron scattering to establish a correlation between structural features and spin arrangement, resolve heat dissipation at the nanometer scale, and provide predictive macroscopic heating metrics.

In this talk, I will focus on maghemite nanoflowers, excellent nanotransducers in magnetic hyperthermia, yet the influence of intra-particle disorder on their magnetization reversal and associated heat release has remained so far elusive. Using micromagnetic simulations, we have modeled the particular morphology and calculated the associated intra-particle spin textures, identifying the location of intra-particle “hot-spots” and the optimal nanoparticle design.