3rd ICQMT 2025

3rd International Conference on Quantum Materials and Technologies

3D PRİNTİNG OF MAGNETİC AND SUPERCONDUCTİNG NANOSTRUCTURES: A NEW PLATFORM TO İNVESTİGATE THREE-DİMENSİONAL EFFECTS AT THE NANOSCALE

Distinguished Professor Amalio Fernández-Pacheco

Amalio Fernández-Pacheco is a University Professor at the Institute of Applied Physics in Vienna University of Technology, being the Head of the Physics of 3D Nanomaterials research group.
Before this position, he spent most of his academic career in UK universities (Cambridge, Glasgow and Imperial College). His research is focused on the advanced investigation of three-dimensional nanomaterials for applications in green computing. For this, he combines advanced 3D nanofabrication, thin film deposition, optical, and X-ray synchrotron techniques. Among his awards, he has been a Marie Curie Fellow, an EPSRC Early Career Fellow, a Winton Advanced Research Fellow, and a Fellow of Sidney Sussex College Cambridge. He currently serves as the Chair of the IEEE Magnetics Chapter in Austria. Since 2021, he leads the ERC Consolidator project 3DNANOMAG, dedicated to the advanced investigation of novel effects in three dimensional magnetic nanostructures.

Date and Time:
From 26 April to 3 May 2025, exact day&time will be announced later.

Lecture Room:
TBD

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10th ICSM 2025

10th International Conference on Superconductivity and Magnetism

Abstract

The expansion of nanotechnology into three dimensions offers exciting opportunities to uncover new physical phenomena and paves the way for the development of advanced 3D devices for future computing technologies. However, the transition to 3D poses significant challenges, necessitating the adoption of cutting-edge nanofabrication techniques that go beyond conventional lithography.

In this talk, I will present our pioneering work on nanoscale 3D printing using focused electron-beam-induced deposition. This innovative platform, developed by our team, enables the precise fabrication of arbitrary 3D nano-geometries for the first time. This breakthrough opens up new avenues for experimental investigations of novel effects arising from the transition to three-dimensionality, particularly in fields such as nanomagnetism and superconductivity.

I will showcase several examples of 3D nano-devices where these new effects have been observed. These include the creation of complex topological spin textures and defects, the emergence of topological stray fields in free space, the controlled motion of domain walls driven by strong 3D geometric gradients, unconventional magnetotransport effects stemming from intricate demagnetizing fields, and the reconfigurability of superconducting vortex circuits.

Additionally, I will discuss complementary characterization and computational tools developed by our group, such as Dark-field magneto-optics, and explore the potential applications of 3D nanostructures in fields like spintronics, magnonics, and fluxonics.

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