**Symposium on Quantum Materials Synthesis, Porto, October 22 - 24, 2025**

# Dynamics of complex polar textures in ferroelectric nanostructures

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Nanostructured ferroelectrics display exotic multidomain configurations resulting from the reduced dimensionality. In fact, the past decade has witnessed dramatic progress related to various aspects of emergent topological polar textures in oxide nanostructures which can display vortices, skyrmions, merons, hopfions, among others under suitable mechanical or electric boundary conditions [1]. These particle-like objects lead to interesting functional properties such as negative capacitance [2], chirality [3] or stochastic ultrafast dynamics [4].
Understanding and controlling such particle-like dynamics is crucial for their usage in nanoelectronic devices, akin to the meticulous control achieved with their magnetic counterparts [5]. Although many advances have been reported recently, the practical generation and manipulation of such polar textures remains nowadays very limited. In this talk, we shall explore different approaches based on temperature, mechanical stimuli and electric fields [6-8] to achieve domain dynamics of such complex polar textures. Moreover, the atomistic resolution of our second-principles molecular dynamics simulations will provide unique insights of these transformations. Finally, we will also discuss recent theoretical findings revealing unconventional responses of topological textures under the effect of electric fields, offering promising avenues for tunable dielectric functionalities in nanoscale devices.

F.G.O. acknowledges financial support from MSCA-PF 101148906 funded by the European Union and the Fonds de la Recherche Scientifique (FNRS) through the FNRS-CR 1.B.227.25F grant.

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