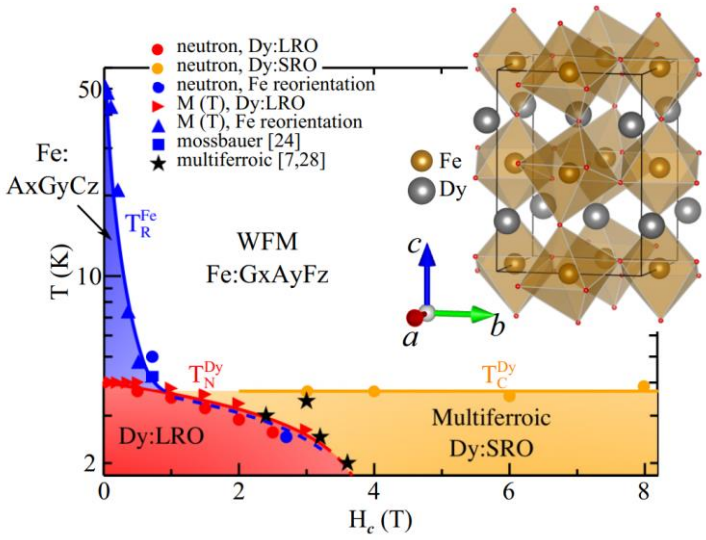
Symposium on Quantum Materials Synthesis, Porto, October 22 - 24, 2025

Epitaxial control of octahedral rotations in antiferromagnetic $DyFeO_3$

Arun K. Jaiswal, Stefano Gariglio, Andrea D. Caviglia

Department of Quantum Matter Physics, University of Geneva, Switzerland

Multiferroic materials, where two or more "ferroic orders" coexist in a single phase, offer great potential in technological applications. In this regard, rare earth orthoferrites (*e.g.*, $DyFeO_3$, DFO) have shown a very rich phase diagram. Besides the antiferromagnetic transition associated with Fe^{3+} and Dy^{3+} orders ($T_{N,Fe}$ ~ 645K, $T_{N,Dy}$ ~ 4K), DFO shows a spin-reorientation (of Fe lattice) phase transition defined by the strong exchange interaction between Fe^{3+} and Dy^{3+}(T_{SR} ~ 50K) [1]. In addition, a magnetic field induces a ferroelectric (FE) state below $T_{N,Dy}$, making DFO a multiferroic, where the weak ferromagnetic and polar orders are aligned parallel to each other. A recent theoretical calculation predicts the strain-induced FE state in DFO thin films even well above the room temperature and thus realizing a strong multiferroic material above room temperature [2]. In this work, we report on the growth of DFO thin films on different substrates with various orientations. A detailed structural investigation allowed us to resolve the epitaxial relation between the film and substrates and highlights the strong influence of the strain on the structural properties, *e.g.*, the c-axis of the DFO films is found to switch from out-of-plane to in-plane direction as a function of thickness. Finally, we report on the magnetic properties of DFO thin films.



References:

[1] J.Wang *et al*, Phys. Rev. B **93**, 140403(R) (2016)
[2] Hong Jian Zhao *et al*, 2014 *J. Phys.: Condens. Matter* **26** 472201