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Unveiling the Influence of Local Magnetic Distortions in Ho-Doped Langasite: A Complementary Approach Using Polarised Neutron Diffraction and Angular Resolved Magnetisation Techniques

Thursday, 12 December 2024 11:20 (30 minutes)

In this presentation, we will explore the complex magnetic behaviour of Ho-doped langasite ($[\text{La}_{1-x}\text{Ho}_x]_3\text{Ga}_5\text{SiO}_{14}$), focusing on understanding how local structural distortions influence the ising-like Ho^{3+} moments and ultimately the macroscopic magnetoelectric properties. The study leverages complementary experimental evidence, combining polarised neutron diffraction and angular-dependent magnetisation measurements to precisely determine the atomic site susceptibility tensor and reconcile it within the constraints of the local-ionic and global symmetries. The analysis incorporates a novel framework that models the orientations of the Ho^{3+} ising axes, along with symmetric rotations around the trigonal C_3 axis that restore the global $P312$ symmetry, despite the presence of broken local C_2 symmetry. The conclusions provide insights into the interplay between local distortions, magnetic anisotropies and macroscopic magnetic and magnetoelectric behaviour, underscoring the importance of polarised neutron diffraction in resolving subtle magnetic features that are otherwise obscured in complex materials such as multiferroics and other systems with strong spin-lattice coupling.

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