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Site-specific X-ray magnetic circular dichroism in high quality Mn_3Ge ferrimagnetic epitaxial films

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Ferrimagnetic tetragonal Mn-based Heusler compound family Mn_3G ($G=Ga, Ge$) has attracted much attention in the last decade due to the strong magneto-crystalline anisotropy along the c -axis [1], small magnetic moment [1] and high spin polarization [2], thus standing as a good candidate for non-volatile and efficient high density magnetic random access memories. In this family of materials, two inequivalent Mn sublattices are coupled antiparallely and give rise to a ferrimagnetic arrangement with a small overall magnetic moment. However, some theoretical and experimental studies pointed out some problems of reproducibility between samples, and a possible moment canting at one Mn site [3], owing to the magnetic frustration occurring in this compound. The full magnetic characterization of those compounds is very challenging but necessary to demonstrate their high potential for information storage applications.

Figure caption: X-ray magnetic circular dichroism at Mn L_3 edge as a function of the applied field and the corresponding vertical line profiles.

In this study, the epitaxial growth of Mn_3Ge thin films will be presented together with a structural and chemical ordering characterization, demonstrating the high quality of the films. Then, X-ray Absorption Spectroscopy and X-ray Magnetic Circular Dichroism (XMCD) measurements are conducted and allow us to unveil the magnetic ground state. In particular, the dichroic signals of both Mn sublattices can be distinguished at the Mn L_3 edge, as shown in figure \ref{fig}. XMCD measurements as a function of the applied magnetic field and the angular incidence of the X-rays both support a normal collinear ferrimagnetic ground state with one Mn sublattice having a very large magnetic anisotropy.

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