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Exploring spin reorientation and structural stability in distorted kagome metal RAgGe (R = Tb, Dy)

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Distorted kagome metals have emerged as fertile platforms for investigating the interplay between geometrical frustration, magnetoelastic coupling, and exotic electronic states. Rare-earth based kagome metal RAgGe (R = Tb, Dy) crystallize in a hexagonal structure that hosts a distorted kagome network of magnetic ions, providing an intriguing platform to study field-induced spin reorientation in frustrated systems. In this work, we investigate the magnetic anisotropy and spin reorientation behavior of TbAgGe and DyAgGe using X-ray magnetic circular dichroism (XMCD) and X-ray magnetic linear dichroism (XMLD) at the rare-earth M4,5 edges. XMCD reveals strong magnetocrystalline anisotropy arising from crystal field effects and highlights the gradual evolution of 4f moment orientation under applied magnetic field. Complementary XMLD measurements provide direct evidence of exchange-driven spin arrangement and local crystal field anisotropy. The distinct dichroic responses of Tb and Dy compounds indicate element-specific reorientation mechanisms governed by their 4f–ligand hybridization strength and single-ion anisotropy. The robustness of the hexagonal crystal framework down to low temperature, evidenced by Extended X-ray absorption fine structure (EXAFS) and Raman spectroscopy, revealing that the distorted kagome geometry remains structurally resilient, with no evidence of symmetry breaking despite noticeable shifts in bond angles and interlayer spacing. These results establish spin dynamics and structural stability in distorted kagome systems and pave the way for understanding magnetic frustration and anisotropy-driven transitions in rare-earth intermetallics.

email address

jayjit.kumar.dey@desy.de

Affiliation

Deutsches Elektronen-Synchrotron DESY

Author: DEY, Jayjit Kumar (Deutsches Elektronen-Synchrotron DESY)

Co-authors: HOESCH, Moritz (Deutsches Elektronen-Synchrotron DESY); Dr CHOWDHURY, Sourav (Deutsches Elektronen-Synchrotron DESY)

Presenter: DEY, Jayjit Kumar (Deutsches Elektronen-Synchrotron DESY)

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