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Nanoscale origins of Non-Joulian magnetostriction in Fe-Ga alloys ALEXANDER GRAY, RAVINI CHANDRASENA, WEIBING YANG, Department of Physics, Temple University, Philadelphia, PA, USA, ANDREAS SCHOLL, ELKE ARENHOLZ, Advanced Light Source, Lawrence Berkeley National Laboratory, Berkeley, CA, USA, MARTIN HOLT, Center for Nanoscale Materials, Argonne National Laboratory, Argonne, IL, USA, JAN MINAR, HUBERT EBERT, Department Chemie, Ludwig-Maximilians-Universitat Munchen, Munchen, Germany, HARSH DEEP CHOPRA, Mechanical Engineering Department, Temple University, Philadelphia, PA, USA — Recently, a new class of single-crystalline magnets exhibiting a 'giant' non-volume-conserving or non-Joulian magnetostriction was discovered [1]. Electronic-structural mechanism giving rise to this unusual phenomenon is not well understood. Here we show the results of our recent investigations of non-Joulian Fe-Ga alloys using high-resolution polarization-dependent photoelectron microscopy (XMCD-PEEM), x-ray absorption spectroscopy (XAS) and hard x-ray nanodiffraction. Strong coupling between the nanoscale modulations in the magnetic and structural properties is observed. The results are compared with the state-of-the-art first-principles theoretical calculations. Combining spectromicroscopic techniques that probe electronic, magnetic and structural degrees of freedom on the nanoscale provides a powerful experimental platform for studying such materials. [1] H. D. Chopra and M. Wuttig, Non-Joulian magnetostriction, Nature 521, 340 (2015).

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