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Writing and reading chiral domains in multiferroic $DyMnO_3$ using soft X-rays E. SCHIERLE, V. SOLTWISCH, D. SCHMITZ, R. FEYERHERM, A. MALJUK, F. YOKAICHIYA, D.N. ARGYRIOU, E. WESCHKE, Helmholtz-Zentrum Berlin fur Materialien und Energie, Berlin, Germany — The structure and dynamics of domains and domain walls are at the heart of any device that utilizes the properties of a ferroic material. Multiferroics, materials that exhibit a strong coupling between ferroelectric and magnetic order, offer the possibility of rich and complex domain arrangement that can be exploited for spintronics and magneto-electric devices. However, due to the complex magnetic order that is found in multiferroics, imaging of domains of a composite ferroic nature is challenging. We report on soft X-ray studies of the multiferroic material $DyMnO_3$, where regions of opposite ferroelectric polarization correspond to magnetic domains of opposite chirality due to the spin-driven nature of ferroelectricity. With local charging induced by the X-ray beam via the photoelectric effect we are able to imprint a pattern of chiral magnetic domains on the surface of a single crystal. We utilize the circular dichroism in magnetic X-ray diffraction caused by the cycloidal magnetic ordering of the Dy-4f moments to read out the chiral domains, taking further advantage of the large enhancement at the Dy-M_5 resonance. The method we describe here suggests a novel approach to control and image domains and domain walls in multiferroic materials.

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