Spectro-microscopy of surface magnetization in Fe_3GeTe_2

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The spatial variation of the magnetic structure in Fe_3GeTe_2 has been in the past investigated by scanning tunneling microscopy, magnetic force microscopy, X-ray circular magnetic dichroism (XMCD), scanning electron microscopy with polarization analysis imaging, and Lorentz transmission electron microscopy. The domain pattern in the absence of an external magnetic field follows the predicted pattern observed for thick crystals with uniaxial magnetic anisotropy. Unlike the techniques mentioned above, Low-energy electron microscopy (LEEM) measurements with a tilted incident electron beam do not require special sample preparation, or a spin-polarized electron source, as in the case of spin-polarized LEEM experiments. Magnetic contrast can be observed by physically tilting the incident electron beam relative to the sample surface normal (or tilting the sample). Here we will show how the observed pattern can be interpreted to extract the domain wall type and determine critical exponents of the surface magnetism[1].

Keywords: van der Waals materials, surface magnetism, low-energy electron microscopy, X-ray magnetic circular dichroism.

Acknowledgement: This research used resources of the Center for Functional Nanomaterials and the National Synchrotron Light Source II, which are U.S. Department of Energy (DOE) Office of Science facilities at Brookhaven National Laboratory, under Contract No. DE-SC0012704.

[1] Trevor A. Tyson, Sandun Amarasinghe, AM Milinda Abeykoon, Roger Lalancette, S. Kai Du, Xiaochen Fang, Sang -W. Cheong, Abdullah Al-Mahboob, and Jerzy T. Sadowski, "*Surface magnetism in Fe3GeTe2 van der Waals ferromagnet*", 2D Materials (12) 025021 (2025).

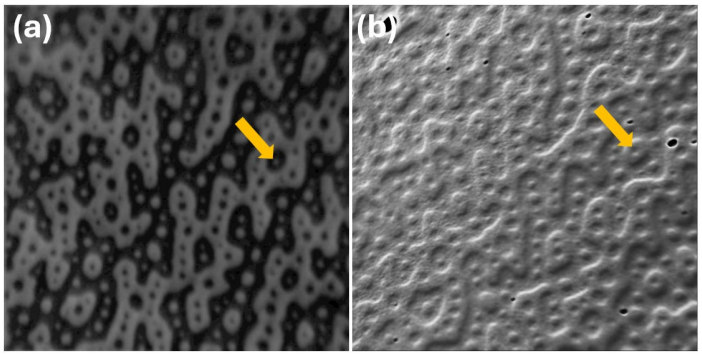

Figure 1. (a) XMCD-PEEM image taken at 110 K. The dark and bright regions correspond to up and down magnetization orientation relative to the sample normal. XMCD images were taken at the peak of the Fe L3-edge spectrum. (b) A tilted-beam LEEM image of the same area as in (a) showing a surface magnetic contrast at domain walls.