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**Magnetic imaging of domain walls and surface magnetism in antiferromagnetic topological insulator $MnBi_2Te_4$**[1]

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The control of domain walls or spin textures is crucial for spintronic applications of antiferromagnets [1,2]. Despite many efforts, it has been challenging to directly visualize antiferromagnetic domains or domain walls, especially in magnetic field [3]. In this talk, I will present our recent results of magnetic imaging of domain walls in several uniaxial antiferromagnets, including the topological insulator $MnBi_2Te_4$ family and topological semimetal $EuMnBi_2$, using cryogenic magnetic force microscopy (MFM) [4]. Our MFM results reveal higher magnetic susceptibility inside the domain walls due to the winding of the antiferromagnetic order parameter. Domain walls in these antiferromagnets form randomly with strong thermal and magnetic field dependence. The direct visualization of these domain walls and domain structures in magnetic field will not only facilitate the exploration of intrinsic topological phenomena in antiferromagnets [2], but will also open a new path toward control and manipulation of domain walls or spin textures in functional antiferromagnets [1]. If time allows, I will present our MFM results of the robust A-type order on the surface of $MnBi_2Te_4$ [5], which might shed light on the mystery of gapless topological surface states observed by angle-resolved photoemission spectroscopy [68]. References: [1] V. Baltz, A. Manchon, M. Tsoi, T. Moriyama, T. Ono, and Y. Tserkovnyak, Rev. Mod. Phys. 90, 15005 (2018). [2] L. mejkal, Y. Mokrousov, B. Yan, and A. H. Macdonald, Nat Phys 14, 242 (2018). [3] S. W. Cheong, M. Fiebig, W. Wu, L. Chapon, and V. Kiryukhin, Npj Quantum Mater. 5, 1 (2020). [4] P. M. Sass, W. Ge, J. Yan, D. Obeysekera, J. J. Yang, and W. Wu, Nano Lett. 20, 2609 (2020). [5] P. M. Sass, J. Kim, D. Vanderbilt, J. Yan, and W. Wu, Phys. Rev. Lett. 125, 037201 (2020). [6] H. Li, S.-Y. Gao, S.-F. Duan, Y.-F. Xu, K.-J. Zhu, S.-J. Tian, W.-H. Fan, Z.-C. Rao, J.-R. Huang, J.-J. Li, Z.-T. Liu, W.-L. Liu, Y.-B. Huang, Y.-L. Li, Y. Liu, G.-B. Zhang, H.-C. Lei, Y.-G. Shi, W.-T. Zhang, H.-M. Weng, T. Qian, and H. Ding, Phys. Rev. X 9, 041039 (2019). [7] Y. J. Chen, L. X. Xu, J. H. Li, Y. W. Li, C. F. Zhang, H. Li, Y. Wu, A. J. Liang, C. Chen, S. W. Jung, C. Cacho, H. Y. Wang, Y. H. Mao, S. Liu, M. X. Wang, Y. F. Guo, Y. Xu, Z. K. Liu, L. X. Yang, and Y. L. Chen, Phys. Rev. X 9, 041040 (2019). [8] Y.-J. Hao, P. Liu, Y. Feng, X.-M. Ma, E. F. Schwier, M. Arita, S. Kumar, C. Hu, R. Lu, M. Zeng, Y. Wang, Z. Hao, H. Sun, K. Zhang, J. Mei, N. Ni, L. Wu, K. Shimada, C. Chen, Q. Liu, and C. Liu, Phys. Rev. X 9, 041038 (2019).

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