Applying spin polarized electron beams to image chiral magnetization textures

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Spin polarized electron beams can be applied in low energy electron microscopy to map the orientation of the 3D magnetization vector at high spatial and angular resolution. This application offers uniquely powerful opportunities to investigate the rich physics of chiral magnetism in films and multilayers. This magnetic chirality is fundamentally interesting holds potential for logic and memory applications [1,2]. Using spin-polarized low-energy electron microscopy (SPLEEM), we recently observed chiral domain walls in thin films [3]. We developed a way to tailor and amplify the Dzyaloshinskii-Moriya interaction, which drives the chirality, by interface engineering [4]. We also demonstrate an experimental approach to stabilize skyrmions in magnetic multilayers without external magnetic field, by exchange-coupling homochiral magnetic films to buried layers with perpendicular magnetization [5]; and we demonstrate that chiral spin textures are induced at graphene/ferromagnetic metal interfaces, via a new type of Dzyaloshinskii-Moriya interaction due to a Rashba effect [6]. This work was done in collaboration with T.P. Ma, A.T. N'diaye, S.P. Kang, H.Y. Kwon, C. Won, Z.Q. Qiu, Y.Z. Wu, A. Mascaraque, H. Yang, A.A.C. Cotta, S.A. Nikolaev, E.A. Soares, W.A.A. Macedo, K. Liu, A. Fert and M. Chshiev.

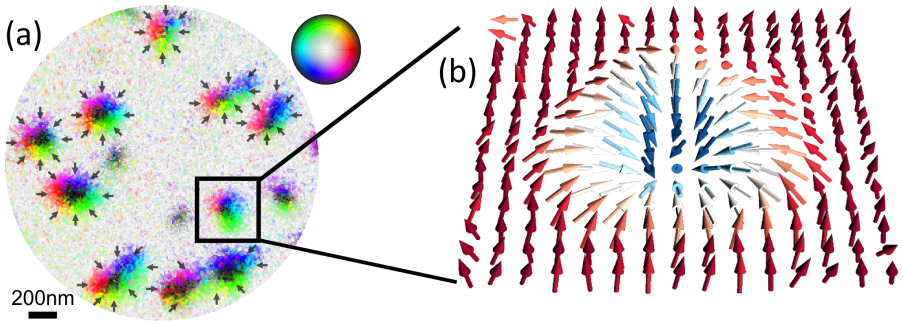

Figure. 1 (a) SPLEEM image of skyrmions in magnetic multilayer designed to stabilize ambient-temperature skyrmion phase [5]. Magnetization vector orientation rendered in color according to color-wheel. (b) Single skyrmion image, 3D vector array shows magnetization at image pixels.

References

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