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Magnetic Stripe Phase at the Spin Reorientation Transition of an Ultrathin Magnetic Film[1]

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Magnetic long-range order can not exist in an isotropic 2D Heisenberg system at any finite temperature, but could be established by adding a magnetic anisotropy to the system. In experiment, this topic has been addressed by investigating the so-called spin reorientation transition (SRT) in magnetic ultra-thin films, where the perpendicular magneto-crystalline anisotropy cancels the in-plane magnetic shape anisotropy. In this talk, we present our study on the SRT of Fe/Ni/Cu(100) system using Photoemission Electron Microscopy (PEEM) chamber at beam line 7.3.1.1 of the Advanced Light Source. We show that (1) a homogenous magnetic state is energetically unstable against the formation of magnetic stripe domains, (2) the stripe domain width decreases exponentially towards the SRT point, and (3) the Curie temperature of the film is reduced to result in a paramagnetic phase within a narrow thickness gap in the SRT region. Using magnetic interlayer coupling to simulate the effect of an external magnetic field, we further studied the SRT in Co/Cu/(Fe/Ni)/Cu(100) system and revealed a universal behavior of the stripe domain width. Moreover a new metastable bubble domain phase was observed near the SRT point in Fe/Ni film, which enriches the magnetic phase diagram of a 2D magnetic system.

[1]Work was done in collaboration with C. Won, J. Choi, J. Wu, A, Doran, A. Scholl, and Z. Q. Qiu.