Chirality effects in the magnetism of ultrathin films

André THIAVILLE

Laboratoire de Physique des Solides, CNRS UMR 8502, Université Paris-Sud,
Bâtiment 510, Centre universitaire, 91405 Orsay, France

andre.thiaville@u-psud.fr

The magnetism of condensed matter differs from that of atoms by the so-called exchange interactions, which couple spins of neighboring atoms and produce collective phenomena. The exchange is typically ferromagnetic or antiferromagnetic, giving rise to a variety of magnetic orders. In addition, the atomic structure of condensed matter leads to magnetic anisotropy, with easier and harder directions along which a sample can be magnetized. Finally, magnetic moments interact at long distances by the magnetic field they create, the driving force for the zoo of domain structures, which can be observed, and explain the magnetization vs. field loops any particular sample. In the presence of a surface or interface, as experimentally studied in the last 35 years, all these interactions are modified so that ultrathin magnetic films can be seen as synthetic new magnetic materials [1].

In this context, I will discuss the latest discovered magnetic interaction at an interface, namely another form of the exchange interaction that favors non-collinear magnetic structures, with a definite chirality. The numerous observed consequences of this interaction will be presented. One group of effects modifies the physics of magnetic domain walls (see an example in Fig. 1). Another group of effects leads to small magnetic domains with topological properties, known as skyrmions [2].

[1] E. du Trémolet de Lacheisserie, D. Gignoux, M. Schlenker (Eds.), *Magnetism* (Springer, New York, 2005)
[2] F. Hellman, et al., Interface-induced phenomena in magnetism, Rev. Mod. Phys. **89**, 025006 (2017)

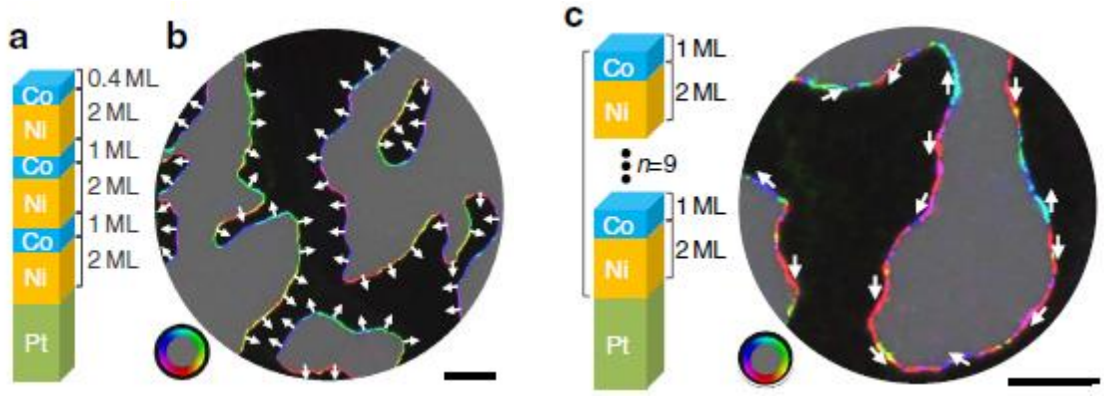

Figure 1 : Imaging of magnetic domain walls by spin-polarized low energy electron microscopy, showing change of structure as thickness increases (G. Chen et al., Nat. Commun. **4** :2671 (2013)).