# Skyrmions, spin torques and emergent electrodynamics

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In chiral magnets a novel phase has recently discovered [1], which can be described as a lattice of topologically quantized magnetic whirls, so-called skyrmions.
When an electron moves in such a magnetic structure, its spin-orientation adapts constantly, thereby inducing forces that act on both the magnetic structure and the electron. These forces can be described by electric and magnetic fields of an emergent electrodynamics.
The topologically quantized winding number of the skyrmions induces exactly one quantum of emergent magnetic flux. In turn a moving skyrmion is predicted to induce an emergent electric field following Faraday's law of induction. We discuss Hall effect measurement [3] which quantitatively measure the emergent electric and magnetic field and allow to determine the velocity of skyrmions and to study their depinning transition.
Furthermore, we discuss that measurements of the rotation angle of skyrmions in the presence of small field or temperature gradients [2] allow to obtain complementary information on the forces determining the skyrmion dynamics.

*[1] Skyrmion Lattice in a Chiral Magnet, Mühlbauer, S., Binz, B., Jonietz, F., Pfleiderer, C., Rosch, A., Neubauer, A., Georgii, R., and Böni, P. Science 323, 915 (2009).*

*[2] Spin Transfer Torques in MnSi at Ultralow Current Densities, Jonietz, F., Mühlbauer, S., Pfleiderer, C., Neubauer, A., Münzer, W., Bauer, A., Adams, T., Georgii, R., Böni, P., Duine, R. A., Everschor, K., Garst, M., and Rosch, A. Science 330, 1648 Dec (2010).*

*[3] Emergent electrodynamics of skyrmions in a chiral magnet, T. Schulz, R. Ritz, A. Bauer, M. Halder, M. Wagner, C. Franz, and C. Pfleiderer, K. Everschor, M. Garst, and A. Rosch, preprint, submitted.*