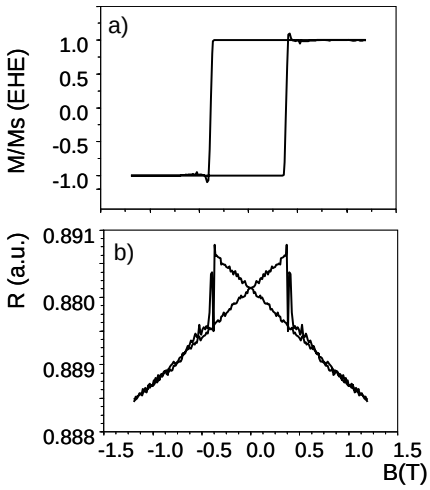
ELECTRON-MAGNON SCATTERING AND MAGNETIZATION SWITCHING DETECTION IN PERPENDICULARLY MAGNETIZED THIN FILMS AND NANOWIRES

A. Mihai, C. Beigné, A. Marty, L. Vila, P. Warin, Y. Samson, J.-P. Attané
CEA/UJF, Inac/SP2M/Lab. NM, Grenoble, France

Studies of domain-wall propagation induced by spin injection require magnetization reversal detection to localize the domain wall. This contribution presents a new detection method, based on simple resistivity measurements in single layers.
Extraordinary Hall Effect (EHE) (fig. a) and resistivity measurements (fig. b) have been performed on epitaxial FePt/MgO(001) thin films deposited by Molecular Beam Epitaxy. The FePt layer exhibit a huge perpendicular anisotropy ($Ku \sim 10^6 J/m^3$)[1], and a square hysteresis loop.
The resistivity evolution vs. the applied field includes a magneto-resistance contribution due to electron-magnon scattering (cf. fig. b): the Magnon Magneto-Resistance (MMR). Each magnetization reversal induces a decrease of resistivity of roughly 0.15%.



The dependence of the electron-magnon scattering contribution with the applied field is known to be linear at very high fields (>>1 T)[2]. We show that in our samples this contribution also depends upon the magnetization state, thus giving rise to the MMR[3]. The theoretical analysis of this phenomenon relates the presence of the MMR to the strong anisotropy ($H_A \sim 10T$) of the FePt layer.
Finally, we show that MMR measurements constitute a new tool to detect magnetization switching, and we discuss its advantages and disadvantages in regard to usual magnetization switching detection tools (EHE, GMR…).

[1] J-P. Attané et al. Phys. Rev. Lett. **93**, 257203 (2004)
[2] B. Raquet et al. Phys. Rev. B **66**, 024443 (2002).
[3] A.P. Mihai et al. Phys. Rev. B **77**, 060401(R) (2008)