

Interaction between dynamical magnetic effects and electrical transport in nano and atomic structures

Michel Viret, Soraya Sangiao, Olivier Rousseau, Christian Hahn, Grégoire de Loubens
Service de Physique de l'Etat Condensé, Commissariat à l'Energie Atomique, DSM/IRAMIS,
CEA Saclay, 91191 Gif-Sur-Yvette, France

Recent progress on full electrical detection of ferromagnetic resonance has opened the way to local electrical measurements of small structures. Two phenomena can be used for detection: the inverse spin Hall effect and the Anisotropic magneto-resistance. The former is proportional to a length and therefore cannot be scaled down to tiny structures. On the other hand, a resistive measurement can be adapted to measuring nano-particles or even atomic sized contacts as long as a current can be passed through the structures.

We demonstrate here that indeed the two effects can be successfully used to measure the resonance properties of magnetic nanostructures. The technique is particularly well adapted to measuring domain walls in constrictions. I will present here our recent work on transverse domain walls in permalloy nano-strips. The constrictions can be further stretched and controllably broken to yield atomic contacts. In this latter geometry, I will present evidence for a giant susceptibility of domain walls constrained on a few cobalt atoms. Finally, I will show that spin currents in insulators can also be detected by inverse spin Hall effect, thus opening the way to using insulators in spintronic devices.