Spin Transport in Magnetic Insulators

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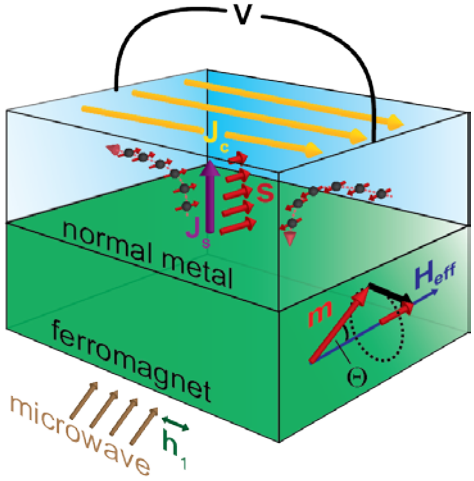
A pure spin current – i.e., the directed flow of spin angular momentum – is a fascinating manifestation of spin physics in the solid state. In ferromagnet/normal metal thin film heterostructures, pure spin currents can be generated, e.g., by means of spin pumping [1], or via the application of thermal gradients in the so-called spin Seebeck effect [2]. An elegant scheme for detecting spin currents relies on the inverse spin Hall effect: because of spin-orbit coupling, a spin current also induces a charge current, which then can be detected using conventional electronics [1,2].

In the talk, I will give an overview over our recent experiments on spin current transport in ferromagnet/normal metal hybrid devices [3-6]. Our results show that spin current generation is possible from both electrically conductive as well as electrically insulating ferromagnets (so-called ferromagnetic insulators), with comparable efficiency. The second part of the talk will then be devoted to the so-called spin Seebeck effect in ferromagnet/normal metal heterostructures. I will give a basic introduction to the spin Seebeck effect arising in magnetic insulator/normal metal bilayers, and critically compare the spin Seebeck effect to its well established, charge-based counterpart. Based on spin Seebeck measurements in different material systems, I will highlight new insights and open issues in spin Seebeck physics. If time permits, I will finally touch upon a novel magneto-resistance effect arising from the interplay between spin and charge currents in magnetic insulator/normal metal heterostructures.



References

[1] O. Mosendz *et al.*, Phys. Rev. Lett. **104**, 046601 (2010).
[2] K. Uchida *et al.*, Nature Mater. **9**, 894 (2010).
[3] F. D. Czeschka *et al.*, Phys. Rev. Lett. **107**, 046601 (2011).
[4] M. Weiler *et al.*, Phys. Rev. Lett. **108**, 106602 (2012).
[5] H. Nakayama *et al.*, Phys. Rev. Lett. **110**, 206601 (2013).
[6] M. Weiler *et al.*, Phys. Rev. Lett. **111**, 176601 (2013).