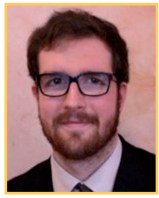

Spin-charge conversion studied by spin pumping in spin-orbit materials

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Spin-charge conversion is one of the main current challenges of spintronics. Our project focuses on its study in gold alloy systems (AuW and AuTa) and in HgTe. Other systems (Ge, STO / metal, BiSbTe, α-Sn), whose physics is close to the above-mentioned systems, are also studied. The growth of these complex systems is carried out within our laboratory or through national and international collaborations. The main method of characterization used is spin pumping by ferromagnetic resonance (Fig.). These measurements are complemented by magnetotransport studies.

Our main results concern:

• the observation of a strong spin-charge conversion up to room temperature, by direct spin pumping into the Fe/Ge(111) interface states, with implications on how to take advantage of the spin–orbit coupling in spin field-effect transistor [1]

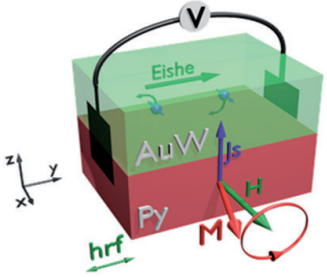

Fig.: The spin pumping technique, here from permalloy to AuW

• an increase of the Hall angle up to 0.5 in AuTa, attributed to the sidejump mechanism on the Ta impurities [2]

• the observation of a very high conversion rate in strained HgTe layers at room temperature, with a non-trivial thickness dependence, which indicates that the conversion mechanism in this topological insulator is very different from those in the spin Hall effect materials [3].

OUTCOMES

[1] Evidence for spin-to-charge conversion by Rashba coupling in metallic states at the Fe/Ge(111) interface, Nat. Commun. 7, 13857 (2016).

[2] Large enhancement of the spin Hall effect in Au by side-jump scattering on Ta impurities, Phys. Rev. B 96, 140405 [R] (2017)

[3] Highly Efficient Spin-to-Charge Current Conversion in Strained HgTe Surface States Protected by a HgCdTe Layer, Phys. Rev. Lett. 120, 167201 (2018)

Oral presentations: 10 oral contributions
best poster prize at Intermag 2017.

Main collaborations: UMP CNRS-Thales (AuTa, AuW, α-Sn and STO / LAO), LETI and NEEL (HgTe), Catalan Institute of Nanosciences and Nanotechnologies (BiSbTe).

Leverage: ANR TOPRISE, ANR OISO