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Spin Hall Magnetoresistance

Pure spin currents, i.e. the net flow of spin angular momentum without an accompanying charge current, represent a new paradigm for spin transport and spintronics. We have experimentally studied two new magnetoresistance effects, which arises from the interaction of charge and spin current flows in ferromagnetic insulator/normal metal hybrid structures.
In a first series of experiments, we measured the resistance of yttrium iron garnet (YIG)/Pt, YIG/nonferromagnet/Pt, nickel ferrite/Pt, and magnetite/Pt hybrid structures as a function of the magnitude and the orientation of an external magnetic field. The resistance changes observed can be quantitatively traced back to the combined action of spin Hall and inverse spin Hall effect in the Pt metal layer, and are thus termed spin Hall magnetoresistance (SMR) [1,2]. We show that the SMR is qualitatively different from the conventional anisotropic magnetoresistance effect arising in magnetic metals and is not due to a static proximity magnetization in Pt.
In a second series of experiments, we study the local and non-local magnetoresistance of thin Pt strips deposited onto yttrium iron garnet [3]. We compare the local magnetoresistance response of a Pt strip under current bias and the non-local voltage drop along a second, electrically isolated Pt strip, which is separated from the current carrying one by a few 100 nm. The non-local magnetoresistance exhibits the symmetry expected for a magnon spin accumulation-driven process [4]. Our experiments as a function of temperature and applied field orientation show that the magnon mediated magnetoresistance (MMR) is qualitatively different from the SMR. Especially, the MMR vanishes at temperatures below 10 K while the SMR prevails even at low temperatures.
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[1] Nakayama, Althammer et al., PRL 110, 206601 (2013) / [2] Althammer et al., PRB 87, 224401 (2013)
[3] Goennenwein et al., APL 107 , 172405 (2015) / [4] S. S.-L. Zhang and S. Zhang , PRB 86, 214424 (2012)

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