Influence of Disorder at Insulator-Metal Interface on Spin Transport

M. A. Seyed-Heydari[1], W. Belzig[1], N. Rohling[1]

[1] *Department of Physics, University of Konstanz, D-78457 Konstanz*

Motivated by experimental work showing enhancement of spin transport between yttrium iron garnet and platinum by the thin antiferromagnetic insulator NiO [1,2,3] between them, we consider spin transport through the interface of a non-magnetic metal and a Ferro or antiferromagnetically ordered insulator.
The spin transport is carried by spin-polarized electrons in the metal and by magnons in the insulator. Spin current can be generated by a spin accumulation in the metal due to the inverse spin Hall effect, a microwave field exciting magnons in the insulator, or by a thermal gradient (spin Seebeck effect). The spin current can be computed using Fermi's Golden Rule [4]. For a perfectly clean interface, the in-plane momentum is conserved for the electron-magnon scattering events which govern the spin transport through the interface. We calculate how disorder-induced broadening of the scatting matrix elements with respect to the in-plane momentum influences the spin current. As a general result, we observe that for many experimental setups, one should expect a rather small effect of interface disorder on the measured spin current.

References:

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