JOHANNES GUTENBERG UNIVERSITÄT MAINZ

Seminar: Hard Condensed Matter Theory

Room: Galileo room, 01-128 (Staudinger Weg 9)
Time: Tuesday, 15.10.2019, 14:00

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Relaxation of spin currents by antiferromagnets and magnetocalorics in multilayers

We have observed and analyzed tunable relaxation of a pure spin current by an antiferromagnet in spin-valves. This is achieved by carefully controlling the angle between a resonantly excited ferromagnetic layer pumping the spin current and the Néel vector of the antiferromagnetic layer. The effect is observed as an angle-dependent spin-pumping contribution to the ferromagnetic resonance linewidth. An interplay between spin-mixing conductance and, often disregarded, longitudinal spin conductance is found to underlie our observations, which is in agreement with our recent prediction for related ferromagnetic and synthetic-ferrimagnetic spin valves [1].

We have demonstrated that the magnetocaloric effect (MCE) can be greatly enhanced when the applied field is amplified by an intrinsic Ruderman-Kittel-Kasuya-Yosida (RKKY) exchange in a magnetic multilayer [2]. Our experiments indicate that the implemented low-field switching of the multilayer's magnetic configuration (P to AP) results in a thousand-fold change in the effective RKKY-exchange field focused onto a thin low-T_C ferromagnetic layer, which is thereby driven through its Curie transition. The estimated isothermal entropy change of the order of 10 mJ cm–3 K–1 under an external field of only 1-10 mT greatly exceeds the low-field performance of the best rare-earth based materials used in the adiabatic-demagnetization refrigeration systems. The proposed system is promising for miniaturized refrigerators, heat exchangers, cooled micro- and nanosensors.

[1] arXiv:1906.03124; Phys. Rev. Lett. 122, 147201 (2019); Phys. Rev. B 98, 144401 (2018).
[2] Phys. Rev. Mater. 2, 114402 (2018); Phys. Rev. B 96, 104427 (2017); EPL 118, 37006 (2017).

All interested are cordially welcome!

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