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# Book of Abstracts

# THE FEATURES OF SPIN-TRANSFER TORQUES IN THE NANOWIRE WITH A MAGNETIC TUNNEL JUNCTION AND ITS EFFECT ON THE SPIN-TORQUE DIODE SENSITIVITY

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The effects of transverse quantization of electron states in the nanowire have a significant influence on the spin-dependent properties of the resistance of point nano-contacts and tunnel junction [1]. However, the quantization of energy levels of the free electrons in the presence of spin-dependent exchange splitting can have a significant impact not only on the magnetoresistance (Fig. 1), but also on the spin-transfer torque phenomena in such structures, which are responsible to the high micromagnetic sensitivity of spin diodes [2] and to the spin instability of magnetic contacts [3]. The energy quantization for each spin channel may lead to the quantization of spin-transfer torques ($dJ_s/dV \sim e/4\pi$) corresponding to the quantization of the conductivity channel resistance ($dJ_e/dV \sim e^2/h$). The microwave sensitivity of spin-torque diode based on the magnetic nanowire increases inversely with the reduction of the cross-sectional area (see the insert to the Fig.1), so the issues of the quantization of electronic states may be important in the limit of small sizes at low temperatures , for example, in the case of some magnetic semiconductors.

Taking into account the effect of transverse quantization of the free-electron wave functions in the nanowire tunnel junction, we studied the features of microwave sensitivity of nano-pillar spin-torque diodes. The obtained results may be useful also for the development of highly scalable magnetoresistive memory elements based on the spin-transfer torque effect.

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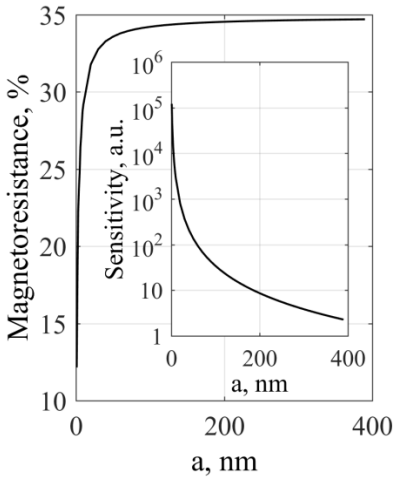


Figure 1. The magnetoresistance of the nanowire tunnel junction with the dielectric spacer vs. its radius (insert: its microwave sensitivity in arb. units)

References:

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