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JOHANNES GUTENBERG UNIVERSITÄT MAINZ

Physikalisches Kolloquium

Dec. 13, 2022 at 4:15 p.m.
HS KPH

Prof. Michael E. Flatté
University of Iowa

Coherent Magnonics for Quantum Information Science

Electric manipulation of magnetization is essential for the integration of magnetic functionalities in integrated circuits. Spin-orbit torque (SOT), originating from the coupling of electron spin and orbital motion through spin-orbital interaction, can effectively manipulate magnetization. Symmetry breaking plays an important role in spintronics based on SOT. SOT requires inversion asymmetry in order to have a net effect on magnetic materials, which is commonly realized by spatial asymmetry: a thin magnetic layer sandwiched between two dissimilar layers. This kind of structure restricts the SOT by mirror and rotational symmetries to have a particular form: an "antidamping-like" component oriented in the film plane even upon reversal of the magnetization direction. Consequently, magnetization perpendicular to the film plane cannot be deterministically switched with pure electric current. To achieve all-electric switching of perpendicular magnetization, it is necessary to break the mirror and rotational symmetries of the sandwiched structure.

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