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Features of spin-orbit-induced dynamics in magnetic nanofilms

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The prospects of the creation of new layered magnetic nanostructures possessing by the property of the field and current-govern magnetic dynamics with ultimately small energy consumption as base elements for nanodevices of an information technology with high bit densities and high-frequency radiation is related to the spin-orbit-induced torque exerting on magnetic states [1]. Such the torques is related to the exchange interaction between localized spins and nolocalized nonequilibrium spins generated by the spin-orbit interaction from conduction electrons [2,3]. The character of nonequilibrium spins determines by the type of the spin-orbit interaction, which is dependent on properties of the magnetic nanostructure. For the two dimensional magnetic systems with the broken inverse symmetry the nonequilibrium spins are the induced spin accumulation straight exerting on magnetic states. For the magnetic nanostructure based on thin magnetic layer sandwiched by insulator and heavy normal metal (e. g., Pt) with the strong enough spin-orbit interaction, the nonequilibrium spins are caused by the spin Hall effect and spin current exerting on magnetic states close to interface.

The problem of the field and current-driven magnetic dynamics includes conditions providing decreasing power consumption, the enhancement of a stability and velocity of magnetic dynamics. Corresponding mechanisms including the spin transport accompanying by an interface reflection, a surface spin accumulation and a magnetic-induced spin pumping have described. In the modified Ladau-Lifshitz model and the quantum-kinetic approach, it is shown similarity of the processes of the induced magnetic dynamics in the ferro- and ferrimagnetic layered nanostructures based on transition magnetic metals.

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