Spin-orbit technologies: memory switching to THz generation

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Current induced spin-orbit torques (SOTs) provide a new way to manipulate the magnetization. We first try to understand various spin textures. In order to probe spin textures, we utilize the bilinear magnetoelectric resistance [1], photovoltage microscopy [2] for topological insulators, and Lorentz transmission electron microscopy [3] for imaging of chiral spin textures, skyrmions in an exchange-coupled Co/Pd multilayer.

We then utilize those spin textures for magnetization switching. We find that a full sign reversal of SOTs occurs as the oxygen bonding increases in Pt/CoFeB/MgO, which evidences an interfacial SOT mechanism [4]. We show much enhanced current induced SOTs from Co/Pd multilayers [5], ferrimagnetic CoGd systems [6], a topological insulator Bi_2Se_3 [7,8] as well as an oxide heterostructure $SrTiO_3/LaAlO_3$ [9,10], which generate strong spin currents to switch the magnetization. In order to understand detailed switching SOT switching mechanism, time resolved SOT spin dynamics is probed [11], and oscillatory SOT switching induced by field-like torques is measured [12]. We propose a field-free SOT switching scheme using one domain wall motion in an anti-notch structure [13]. Finally, we discuss the generation of THz for heavy metal/ferromagnet structures using SOTs [14,15].

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