MAR10-2009-001465

Abstract for an Invited Paper
for the MAR10 Meeting of
the American Physical Society

Spin-transport and spin-transfer torque in SF nanostructures

ERHAI ZHAO, George Mason University

The electronic spin degree of freedom develops interesting dynamics in Superconductor-Ferromagnet nanostructures driven out of equilibrium. Their unique spin transport properties may be exploited to electrically control the state of nanomagnets with the help of superconductors. We present an anatomy of microscopic scattering events (Andreev reflections, spin filtering, spin mixing etc.) in SFS and SFNFS junctions, and elucidate their roles in determining the spin and charge supercurrent in equilibrium, as well as the nonequilibrium spin current and spin- transfer torque under a bias voltage. In particular, we will focus on the nonlinear voltage dependence of spin current in SFS junctions, and the appearance of a new component of the spin-transfer torque that is perpendicular to the plane spanned by the two ferromagnetic moments in SFNFS structures. The latest theoretical developments that made these calculations tractable will be outlined. E. Zhao and J. A. Sauls, Phys. Rev. B 78 174511 (2008); Phys. Rev. Lett. 98 206601 (2007).