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Efficient Generation of Spin Current and Spin Transfer Torque by the Topological Insulator Bismuth Selenide ALEX MELLNIK, JENNIFER GRAB, PETER MINTUN, Department of Physics, Cornell University, JOON SUE LEE, ANTHONY RICHARDELLA, NITIN SAMARTH, Deptartment of Physics, Penn State University, DANIEL RALPH, Department of Physics, Cornell University — We study the use of topological insulators as a source of spin current for applying spin transfer torque to a ferromagnet. We fabricate bismuth selenide / permalloy bilayers and use the spin-torque FMR technique to make quantitative measurements of the torque applied to the magnetic permalloy layer resulting from an in-plane current. Despite the fact that only a small fraction of the current flows in the bismuth selenide, we still observe large spin torque effects. There is a component of torque in the sample plane with the symmetry expected from the spin Hall effect, with a strength corresponding to a spin Hall angle greater than 1, larger than measured for any other material. There is also an additional out-of-plane, field-like torque several times larger than expected from the Oersted field. We will discuss the dependence of these effects on layer thickness, and attempt to distinguish whether they result from bulk or surface-state effects.

Alex Mellnik
Department of Physics, Cornell University

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