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Spin-transfer torque generated by a topological insulator

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Magnetic devices are a leading contender for the implementation of memory and logic technologies that are non-volatile, that can scale to high density and high speed, and that do not wear out. However, widespread application of magnetic memory and logic devices will require the development of efficient mechanisms for reorienting their magnetization using the least possible current and power. We report experiments showing that charge current flowing in-plane in a thin film of the topological insulator Bi_2Se_3 at room temperature can exert a strong spin-transfer torque on an adjacent metallic ferromagnetic layer, with a direction consistent with that expected from a topological surface state. The spin torque efficiency per unit charge current density in the Bi_2Se_3 is larger than any previously measured at room temperature. Our data suggest that topological insulators could enable very efficient electrical manipulation of magnetic materials at room temperature, for memory and logic applications. Related publications: A. R. Mellnik, J. S. Lee, A. Richardella, J. L. Grab, P. J. Mintun, M. H. Fischer, A. Vaezi, A. Manchon, E.-A. Kim, N. Samarth, D. C. Ralph, Nature 511, 449-451 (2014).