Fluctuation-Induced Interfacial Spin State in Topological Insulator Heterostructures

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A bit of information can be stored in a magnetic media between "ON" and "OFF" states separated by an energy barrier [1]. The long lived and robust memory against any external perturbation can be achieved by using magnetic moment, or spin of electrons rather than using a charge [1]. The current dynamics for technological quest is not only controlling the spin state population but also minimizing either the size or the dissipation of the devices to enable spintronic devices possible in daily life. Despite the promising many exotic quantum features, the topological insulators (TIs) have a great potential for supplanting the spintronics, high speed electronics, efficient high density storage, as well as quantum information technology. Using a TI close proximity with a ferromagnet breaks the time reversal symmetry [2] and opens a gap on the surface Dirac cone by introducing a robust interfacial magnetic anisotropy with a unique interfacial spin texture [3]. Introducing a certain spin texture may introduce a topologically protected phase into such systems that might bring long-lived dissipationless information storage. In this talk we will describe the formation of unique spin configuration in engineered TI heterostructures enabling next generation robust data storage system at room temperature. Our experimental approach and models will be discussed. Work supported by MIT MRSEC through the MRSEC Program of NSF under award number DMR-0819762, NSF Grant DMR-1207469, the ONR Grant N00014-13-1-0301, and the STC Center for Integrated Quantum Materials under NSF grant DMR-1231319; the Scientific User Facilities Division, Office of Basic Energy Sciences, and the US Department of Energy, by the Laboratory Directed Research and Development Program of Oak Ridge National Laboratory.

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