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Topological Magnetic Heterostructures of Epitaxial Bi_2Se_3 on $Ga_{1-x}Mn_xAs$ ANTHONY RICHARDELLA, JOON SUE LEE, DAVID W. RENCH, ROBBIE D. FRALEIGH, NITIN SAMARTH, Dept. of Physics and Center for Nanoscale Science, Penn State University, University Park PA 16802 — Topological Insulators (TI) are characterized by conducting surface states with a Dirac-like dispersion protected by time reversal symmetry. A magnetic perturbation that breaks this symmetry, such as placing a ferromagnet in proximity with a TI, can lead to a wide range of unusual effects such as a half integer quantum Hall conductance, magnetic monopoles, or an inverse spin-galvanic effect, among others. Such structures are challenging to create however due to the difficulty in finding insulating magnetic materials that are compatible with topological materials. We demonstrate one approach to this, the epitaxial growth of Bi_2Se_3 on the ferromagnetic semiconductor $Ga_{1-x}Mn_xAs$. We discuss the growth and characterization of these heterostructures, where the Mn concentration of the GaMnAs can be tuned from a highly resistive state near the metal-insulator transition, up to a highly doped semiconductor with a T_C well in excess of 100 K. This allows the study of a wide range of regimes and interactions between the two layers. As GaMnAs is a prototypical material for the demonstration of many spintronic devices, and has a highly tunable anisotropy, this opens up the possibility of an exciting range of hybrid spintronic/Topological Insulator structures. Funded by ONR and DARPA.

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