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Coherent heteroepitaxy of Bi_2Se_3 on GaAs and ZnSe A. RICHARDELLA, D.M. ZHANG, J.S. LEE, A. KOSER, N. SAMARTH, Physics Dept., Penn State University, University Park PA 16802, A. YEATS, B.B. BUCKLEY, D.D. AWSCHALOM, Physics Dept., University of California, Santa Barbara CA 93106 — Bi_2Se_3 is considered to be one to the most promising topological insulator candidate materials currently known because of its 0.3eV bandgap and mid-gap Dirac point. We use molecular beam epitaxy to deposit high quality c-axis oriented single crystal thin films of Bi_2Se_3 on (111) surfaces of GaAs after the growth of either GaAs or ZnSe buffer layers. Atomic force microscopy reveals films with large single quintuple layer terraces hundreds of nanometers wide. Transmission electron microscopy shows an atomically sharp interface at the heterostructure and narrow X-ray diffraction rocking curves indicate good quality single crystalline growth. We discuss the variation in carrier density, mobility and magnetoresistance with growth conditions. Spatially- and temporally-resolved Kerr spectroscopy allows us to explore coherent electron spin dynamics at the interface between this promising topological insulator and conventional semiconductor heterostructures. Supported by NSF and ONR.

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