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Quantum Transport Properties of Bi_2Se_3 Thin Films SERCAN BABAKIRAY, AMIT KC, PAVEL BORISOV, Department of Physics and Astronomy, West Virginia University, Morgantown, WV 26506, DAVID LEDERMAN, Department of Physics, University of California, Santa Cruz, CA 95064 — We address the surface and bulk electronic transport properties of topological insulator Bi_2Se_3 thin films in parallel and perpendicular magnetic fields. Bi_2Se_3 thin films with nominal thickness values of 12, 16, 20 and 25 quintuple layers (QLs) were grown by molecular beam epitaxy (MBE). Epitaxial growth of the films were confirmed by RHEED analysis. Crystal orientation and disorder were studied by XRD scans. XRR was used to confirm the film thickness and roughness. Structural data indicated a slight increase in the disorder with increasing film thickness, but overall the samples were highly crystalline. Weak antilocalization (WAL) was observed in magnetoconductance measurements with the magnetic field applied parallel to the samples' surface and at temperatures between 2 K and 20 K, which indicated a significant contribution to the transport from the bulk states. Large phase coherence lengths with the field applied both perpendicular and parallel to the surface confirmed the diffusive nature of the transport. Quantitatively, the phase coherence lengths ($L_\emptyset$) obtained from the Altshuler-Aronov and Hikami-Nagaoka-Larkin mechanisms were an order of magnitude larger than the film thickness (d) for all of the samples. Parallel magnetoconductance and the corresponding bulk phase coherence lengths were used to estimate the contribution of bulk and surface states in the perpendicular transport.

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