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Low Temperature Quantum Transport Properties of Bi_2Se_3 Topological Insulator Thin Films[1] DAVID LEDERMAN[2], SERCAN BABAKIRAY, PAVEL BORISOV, AMIT KC, YURI GLINKA, West Virginia University — 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) on Al_2O_3 substrates. The magnetoconductance (MC) was analyzed using the two-dimensional Altshuler-Aronov (AA) and Hikami-Larkin-Nagaoka (HLN) mechanisms. Using a simple model where the channels for the bulk and surface states are independent from each other, and assuming that all channels undergo WAL, it was possible to determine the phase coherence length (L_ϕ) of the carriers of the surface and bulk contributions independently from the MC with the field perpendicular to the surface. The value of L_ϕ for the surface states was independent of thickness, as expected, while L_ϕ for the bulk channel was strongly dependent on film thickness. WAL was also measured with the field applied parallel to the surface, and from the MC data in this configuration, it was possible to obtain values for L_ϕ that were similar to the perpendicular configuration for all samples except for the thinnest sample (12 QL), which may be a result of interactions between the metallic surfaces states on opposite sides of the film. We will discuss these results in view of other results from the literature.

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