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# Negative longitudinal magnetoresistance in the topological regime of $\text{Pb}_{1-x}\text{Sn}_x\text{Se}$

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## Abstract

$\text{Pb}_{1-x}\text{Sn}_x\text{Se}$  is a highly tunable material where a topological phase transition from a normal insulator to a topological insulator can be induced by increasing Sn content above a critical composition  $x=0.16$ . [1] We thus study magnetotransport at pulsed magnetic fields in  $\text{Pb}_{1-x}\text{Sn}_x\text{Se}$  for  $x$  varying between 0.1 and 0.3 across the topological phase transition. We report the observation of a negative longitudinal magnetoresistance (NLMR) only in samples that are in the topological regime ( $x > 0.16$ ). This NLMR is only observed when the samples reach the quantum limit. In trivial control samples ( $x < 0.16$ ), the MR is robustly positive up to 60T, suggesting that the NLMR may be a hallmark of the topological insulating state. We argue that this effect can be due to the anomalous behavior of the  $N=0$  Landau levels, predicted to converge and cross, leading to a magnetic field induced closure of the energy gap in topological materials. [2] We thus tie the occurrence of the NLMR to the non-trivial topological character of  $\text{Pb}_{1-x}\text{Sn}_x\text{Se}$ . [3]

B. A. Assaf, T. Phuphachong, V. V. Volobuev, G. Bauer, G. Springholz, L.-A. De Vaultier, and Y. Guldner, Arxiv 1608.08912.

B. A. Bernevig and T. L. Hughes, Topological Insulator and Topological Superconductors (Princeton University Press, 2013).

B.A. Assaf, T. Phuphachong, E. Kampert, V.V. Volobuev, G. Bauer, G. Springholz, L.A. de Vaultier, and Y. Guldner. Arxiv 1704.02021

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