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Disorder-driven breakdown of topological protection in Bi_2Se_3 films. JISOO MOON, Rutgers University, MATTHEW BRAHLEK, Pennsylvania State University, NIKESH KOIRALA, MARYAM SALEHI, Rutgers University, LIANG WU, N. PETER ARMITAGE, The Johns Hopkins University, SEONG-SHIK OH, Rutgers University — In topological insulators (TI), there are unusual metallic states on their surfaces, so-called topological surface states (TSS). They are protected by time reversal symmetry through strong spin-orbit coupling, making them immune to disorder-related localization effects. However, in highly-disordered TIs the crystal momentum becomes ill-defined because translational invariance is broken. In those materials, it is doubtful that topological protection is still valid. In this presentation, we show that high level of disorder drives breakdown of topological protection in Bi_2Se_3 films. TSS in the films are not protected above a critical level of disorder, and the films become trivial insulators. The films are grown by Molecular Beam Epitaxy (MBE), and the level of disorder in the films is controlled by annealing after the films are grown at room temperature.

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