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Quantum Confined Sb: An Elemental Topological Insulator¹ SHAYNE CAIRNS, JEREMY MASSENGALE, ZHONGE-HE LIU, JOEL KEAY, CHOMANI GASPE, KAUSHINI WICKRAMASINGHE, TETSUYA MISHIMA, MICHAEL SANTOS, SHEENA MURPHY, Univ of Oklahoma — Sb is a bulk semi-metal which is predicted to undergo a series of quantum phase transitions from a topological semi-metal to a 3D topological insulator (TI) to a 2D TI to a trivial insulator as a function of decreasing film thickness. We report magneto-transport studies on Sb(111) epilayers with thicknesses ranging from 0.7 to 3.2 nm grown via molecular beam epitaxy on nearly lattice-matched GaSb(111) substrates. For thicknesses greater than 1nm the films are conducting with a non-zero intercept at zero film thickness, indicating residual surface conduction. Below 1nm, there is an abrupt transition to insulating behavior consistent with predictions of a topological to trivial insulator. We have studied the magneto-resistance (MR) up to 18T in both perpendicular and tilted magnetic fields for a range of temperatures. The angular MR indicates 2D transport. For (B¿4T) the MR is increasingly linear as the film thickness is reduced while at lower fields the transport is well described by weak antilocalization (WAL). A straightforward model combing bulk behavior and WAL assists in explaining this thickness evolution. Experiments on quantum interference in quantum wires are ongoing.

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