Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Mapping the band structure of three-dimensional topological insulator Bi2Se3 in two-dimensional limit KE HE, YI ZHANG, CUI-ZU CHANG, CAN-LI SONG, LI-LI WANG, XU-CUN MA, ZHONG FANG, XI DAI, Institute of Physics, Chinese Academy of Sciences, WEN-YU SHAN, SHUN-QING SHEN, The University of Hong Kong, QIAN NIU, The University of Texas, Austin, XIAO-LIANG QI, SHOU-CHENG ZHANG, Stanford University, XI CHEN, JIN-FENG JIA, QI-KUN XUE, Tsinghua University — In this work, with in situ angle-resolved photoemission spectroscopy, we have investigated the thickness dependent band structure of molecular beam epitaxy grown Bi2Se3, a typical three-dimensional insulator, from 1 quintuple layer (QL) up to 200QL. An energy gap is observed in the topologically protected metallic surface states of bulk Bi2Se3 below the thickness of 6QL, due to the coupling between the surface states from two opposite surfaces of the Bi2Se3 film. The gapped surface states exhibit sizable Rashba-type spin-orbit splitting, resulting from breaking of structural inversion symmetry induced by 6H-SiC substrate. The spin-splitting can be controlled by tuning the potential difference between the two surfaces, which can be utilized into electrical spin manipulation.

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Date submitted: 19 Nov 2009 Electronic form version 1.4