Abstract Submitted for the MAR11 Meeting of The American Physical Society

Experimental evidence on a diffusive metallic surface state by the magneto-resistance oscillation in the topological insulating Bi₂Te₃ FENGQI SONG, YUYUAN QIN, ZHAOGUO LI, QIANGHUA WANG, JIANGUO WAN, GUANGHOU WANG, National Lab of Solid State Microstructures, Nanjing University, Nanjing, China, ZHE QU, High Magnetic Field Laboratory, Chinese Academy of Sciences, Hefei, China — The spin helicity seems bound to the generation of the surface state (SS) in a three-dimensional strong topological insulating system. Here we demonstrate a diffusive metallic SS by measuring the magnetoresistance oscillations in the Bi₂Te₃ nanoflakes. The products of the oscillating periods and the cross sections of the flakes result in the values of the flux quantum (h/e) and the half quantum (h/2e). The first observation of the h/2e oscillation shows the violence of the spin helicity of the SS The h/e oscillation persists during increasing the magnetic field, while the h/2e oscillation fails, indicating the diffusive origin of the SS and its weak antilocalization. The diffusive SS is found robust against the increases of the circumference till 10 micrometers and the temperatures till 64K, when the h/e oscillation disappears. The diffusive SS can be further activated by the spin-polarized scattering formed by the deposited Co islands. All the evidence agrees to recent simulations on a weak-localized SS upon the presence of strong disorder centers. This research was supported by the National Key Projects for Basic Research of China (Grant numbers: 2009CB930501, 2010CB923401).

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Date submitted: 18 Nov 2010 Electronic form version 1.4