Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Creation of Dirac cones in two-dimensional HgTe honeycomb lattices produced by gate voltage HUA-HUA FU, SHU-TING PING, HUI WANG, RUQIAN WU, University of California, Irvine — HgTe is the first 2D topological insulator that was confirmed experimentally. In this material, it is well known that HgTe quantum well manifests as a topological insulator only when the parameter M, which is determined by the energy difference between E1 and H1 bands, is negative (M <0). In this study, we demonstrate that the topological feature can still be obtained in the HgTe quantum well with M >0, if we construct a honeycomb mask on 2D HgTe and apply gate voltages. The newly developed topological state has very large and controllable band gaps and can be used for the realization of various topological properties such as fraction Chern insulator and a fractional quantum spin Hall effect. It should be stressed that the newly developed Dirac cones is not ascribed to the band inversion but is driven by the honeycomb mask. Obviously, this idea can be extended to other materials and devices.

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Date submitted: 25 Nov 2015 Electronic form version 1.4