Abstract Submitted for the MAR17 Meeting of The American Physical Society

Novel Planar Hall Effect in the Surface of Topological Insulators ALEXEY TASKIN, HENRY LEGG, FAN YANG, University of Cologne, SATOSHI SASAKI, University of Leeds, YASUSHI KANAI, KAZUHIKO MATSUMOTO, Osaka University, ACHIM ROSCH, YOICHI ANDO, University of Cologne — The progress in the study of topological materials depends on the ability to measure their surface properties. Recent advances in MBE growth allowed us to obtain suitable topological insulators (TIs). Here we report a magneto-transport study of high-quality bulk-insulating $Bi_{2-x}Sb_xTe_3$ thin films, which were fabricated into devices with electrostatic gates on both bottom and top surfaces. For magnetic fields applied parallel to the surface of a TI, we found a clear anisotropy in magnetoresistance (MR) and related planar Hall effect. This anisotropy is a consequence of two fundamental facts: 1) the time-reversal symmetry is broken by the magnetic field, lifting the topological protection of spin-momentum locked Dirac electrons against backscattering from impurities; 2) the in-plane magnetic field does not open the gap in the surface state, preserving the Dirac physics. As a result the back scattering protection can still be maintained for electrons with spins parallel/antiparallel to the direction of the magnetic field, giving rise to the scattering-rate anisotropy. The key signature of anisotropic MR is a strong dependence on the gate voltage with a characteristic two-peak structure near the Dirac point, which was observed by employing the dual-gating technique.

> Alexey Taskin University of Cologne

Date submitted: 10 Nov 2016

Electronic form version 1.4