Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Thin films of topological insulators in a parallel or tilted magnetic field SERGEY PERSHOGUBA, VICTOR YAKOVENKO, Center for Nanophysics and Advanced Materials, Department of Physics, University of Maryland, College Park, Maryland 20742-4111 — In thin films of topological insulators, the surface states on the opposite edges are coupled by a tunneling coupling t. We discuss the energy spectrum and the transport properties of the system in a magnetic field. When an electron tunnels between the edges, the Lorentz force due to the in-plane magnetic field $\mathbf{B = (0, B_y, 0)}$ changes the in-plane electron momentum by $\Delta p_x \propto B_y$. As a result, the Fermi circles on the opposite edges shift by Δp_x in the momentum space. We propose that this effect can be detected by measuring the tunneling conductance $\sigma_{zz}(B_y)$ between the edges of the system. We show that $\sigma_{zz}(B_y)$ has special signatures due to the helical spin configuration of the surface Dirac cones. In case of a tilted field $\mathbf{B = (0, B_y, B_z)}$, the perpendicular component B_z quantizes the in-plane motion to the Landau levels, while the in-plane component B_y spatially shifts the wave functions on the different edges. As the overlap between the wave functions changes, the tunneling amplitude t is renormalized and acquires dependence on both B_y and B_z. This effect can be observed as the dependence of the interlayer conductance and in-plane conductivity on the tilt angle θ of the magnetic field $\tan\theta = B_y/B_z$.

Sergey Pershoguba
Center for Nanophysics and Advanced Materials, Dept of Physics,
University of Maryland, College Park, Maryland 20742-4111

Date submitted: 07 Nov 2011 Electronic form version 1.4