Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

**Anisotropic magnetoresistance of topological-insulator surface states in a parallel magnetic field** A. H. MACDONALD, Department of Physics, University of Texas at Austin, TX 78712, USA, C. M. CANALI, C. M. HOLMQVIST, Department of Physics and Electrical Engineering, Linnaeus University, SE-391 82 Kalmar, Sweden, A. PERTSOVA, Nordita, Roslagstullsbacken 23, SE-106 91 Stockholm, Sweden; Center for Quantum Materials (CQM), KTH and Nordita, Stockholm, Sweden — The influence of external perturbations on the surface-state (SS) transport properties of topological insulators (TI) is presently the subject of intense investigation. We report on a theoretical analysis of the influence of an in-plane magnetic field on SS properties. For 2D electron systems confined to semiconductor quantum wells, in-plane magnetic fields yield transport anisotropy that can be traced to an enhancement in quasiparticle mass for motion in the in-plane direction perpendicular to the field. To verify the existence of a similar anisotropy in the TI SS system, we consider a long-wavelength four-band model of SSs that is relevant for several TIs with the $Bi_2Se_3$ crystal structure. An in-plane field influences the orbital motion, but leaves the SS momenta as good quantum numbers. The ensuing set of four coupled Dirac's equations, is solved numerically. We find that the magnetic field introduces an in-plane anisotropy in the energy dispersion of Dirac's states which affects the conductivity. We compare the size of the anisotropic orbital magnetoresistance with the anisotropy originating from Zeeman coupling. The results of this approximate continuum model are compared with the predictions of a realistic tight-binding model for $Bi_2Se_3$ thin films.

Cecilia Holmqvist
Linnaeus University

Date submitted: 20 Nov 2016 Electronic form version 1.4