Giant anisotropic magneto-resistance in the magnetic topological insulator $\text{Cr}_y(\text{Bi}_{1-x}\text{Sb}_x)_{2-y}\text{Te}_3$ ABHINAV KANDALA, ANTHONY RICHARDELLA, CHAOXING LIU, NITIN SAMARTH, Penn State University —

We demonstrate magnetization control of edge state transport and report the observation of a gate-tunable giant anisotropic magneto-resistance (GAMR) effect in the magnetic topological insulator $\text{Cr}_y(\text{Bi}_{1-x}\text{Sb}_x)_{2-y}\text{Te}_3$ as an external field (and the magnetization $M$) is rotated from out-of-plane (polar angle $\theta = 0^\circ$) to in-plane ($\theta = 90^\circ$). The angular dependence of the GAMR deviates from the standard $\cos^2 \phi$ form (where $\phi$ is the angle between $M$ and the current density $J$), and is instead explained by a Landauer-Buttiker formalism that accounts for bulk-edge mixing. However, the rotation of the magnetization in-plane produces a weak, conventional AMR. These results serve as evidence for a field tilt-tuned crossover between an “imperfect” quantum anomalous Hall insulator (QAH) and a gapless, ferromagnetic topological insulator. We expect the GAMR to become stronger in the ideal QAH regime where edge state conduction dominates over bulk conduction, thus providing a route toward proof-of-concept ferromagnetic topological insulator transistors and magnetic field sensors. Funded by DARPA.