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Giant anisotropic magneto-resistance in the magnetic topological insulator $\mathbf{Cr}_y\mathbf{(Bi}_{1-x}\mathbf{Sb}_x\mathbf{)}_{2-y}\mathbf{Te}_3$ 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 $Cr_y(Bi_{1-x}Sb_x)_{2-y}Te_3$ as an external field (and the magnetization M) is rotated from out-of-plane (polar angle $\theta = 0°$) to in-plane ($\theta = 90°$). The angular dependence of the GAMR deviates from the standard $\cos^2\phi$ form (where ϕ 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.

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