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**Spin-filtered Edge States with an Electrically Tunable Gap in a Two-Dimensional Topological Crystallin Insulator**[1] JUNWEI LIU, Department of Physics, Tsinghua University, TIMOTHY H. HSIEH, PENG WEI, Department of Physics, Massachusetts Institute of Technology, WENHUI DUAN, Department of Physics, Tsinghua University, JAGADEESH MOODERA, LIANG FU, Department of Physics, Massachusetts Institute of Technology — Three-dimensional topological crystalline insulators (TCIs) were recently predicted and observed in the SnTe class of IV-VI semiconductors, which host metallic surface states protected by crystal symmetries. In this work, we study thin films of these materials and expose their potential device applications. We demonstrate that thin films of SnTe and $Pb_{1-x}Sn_xSe(Te)$ grown along the (001) direction are topologically nontrivial in a wide range of film thickness and carry conducting spin-filtered edge states that are protected by the (001) mirror symmetry via a topological invariant. Application of an electric field perpendicular to the film will break the mirror symmetry and generate a band gap in these edge states. This functionality motivates us to propose a novel topological transistor device, in which charge and spin transport are maximally entangled and simultaneously controlled by an electric field. The high on/off operation speed and coupling of spin and charge in such a device may lead to electronic and spintronic applications for TCIs.

[1] J. Liu, *et al.*, arXiv:1310.1044 (2013), (accepted by Nature materials)

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