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**Optical Control of Ferromagnetism in a Magnetically-Doped Topological Insulator**[1] ANDREW L. YEATS, PETER J. MINTUN, Institute for Molecular Engineering, University of Chicago, Chicago, IL 60637, YU PAN, ANTHONY RICHARDELLA, NITIN SAMARTH, Dept. of Physics, Penn State University, University Park, PA 16802, DAVID D. AWSCHALOM, Institute for Molecular Engineering, University of Chicago, Chicago, IL 60637 — Many proposed experiments involving topological insulators (TIs) require spatial control over time-reversal symmetry and chemical potential. We demonstrate micron-scale optical control of both magnetization and chemical potential in thin films of Cr-doped $(Bi,Sb)_2Te_3$. By optically modulating the coercivity of the films, we write and erase arbitrary spatial configurations of their magnetization, which we then image with Kerr microscopy. Additionally, by optically manipulating a space charge layer in the underlying $SrTiO_3$ substrates, we can control the local chemical potential of the films. This allows us to write and erase $p$-$n$ junctions in the films, which we image with photocurrent microscopy[2]. Both effects persist for $> 16$ hours. We will present systematic Kerr microscopy, photocurrent microscopy, and electrical transport studies of these materials and various electronic and magnetic structures patterned on them. We will discuss the prospects for using these optical phenomena to study and control the unique physics of TIs, such as edge-state transport in the quantum anomalous Hall regime.

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[2]A. L. Yeats, Y. Pan, A. Richardella, P. J. Mintun, N. Samarth, and D. D. Awschalom, Science Advances 1, e1500640 (2015).

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