Abstract Submitted
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Persistent Optical Gating of a Topological Insulator Heterostructure[1] ANDREW L. YEATS, Institute for Molecular Engineering, University of Chicago, Chicago, IL 60637 & Dept. of Physics, University of California, Santa Barbara, CA 93106, YU PAN, ANTHONY RICHARDELLA, Dept. of Physics, Penn State University, University Park, PA 16802, PETER J. MINTUN, Institute for Molecular Engineering, University of Chicago, Chicago, IL 60637, 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 & Dept. of Physics, University of California, Santa Barbara, CA 93106 — We demonstrate persistent, bidirectional control of the chemical potential in a $(Bi,Sb)_2Te_3/SrTiO_3$ heterostructure through a two-color all-optical technique. By manipulating the space-charge distribution in a $SrTiO_3$ substrate, we locally tune the field effect in a $(Bi,Sb)_2Te_3$ channel comparably to electrostatic gating techniques but without additional materials or processing. The effect persists for thousands of seconds and functions from cryogenic to ambient temperatures. This enables us to write and re-write arbitrarily shaped p- and n-type regions, which we characterize electrically and image with scanning photocurrent microscopy. The ability to rapidly prototype mesoscopic electronic structures in a topological insulator may aid in the investigation of the spin-polarized surface and edge states unique to the topological insulating phase. The optical patterning technique may be adaptable to other material systems, which could form a basis for reconfigurable electronics.

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