Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Spin-polarized surface resonances accompanying topological surface state formation KENNETH GOTLIEB, Graduate Group in Applied Science and Technology, University of California, Berkeley, CHRIS JOZWIAK, Advanced Light Source, Lawrence Berkeley National Laboratory, JONATHAN SOBOTA, Stanford Institute for Materials and Energy Sciences, SLAC National Accelerator Laboratory, ALEXANDER KEMPER, Department of Physics, North Carolina State University, Raleigh, North Carolina, COSTEL ROTUNDU, Stanford Institute for Materials and Energy Sciences, SLAC National Accelerator Laboratory, ROBERT BIRGENAU, Department of Physics, University of California, Berkeley, ZAHID HUSSAIN, Advanced Light Source, Lawrence Berkeley National Laboratory, DUNG-HAI LEE, Department of Physics, University of California, Berkeley, ZHI-XUN SHEN, Stanford Institute for Materials and Energy Sciences, SLAC National Accelerator Laboratory, ALESSANDRA LANZARA, Department of Physics, University of California, Berkeley — Strong spin-orbit coupling can drive a band inversion that makes a material topologically non-trivial. Using spin, time, and angle-resolved photoemission spectroscopy, we study the unoccupied bandstructure in a topological insulator and find a spin-polarized surface resonance near the topological surface state. This new state is a remnant of Rashba bands on the trivial side of the topological phase transition. From this, we learn how the into the topological surface state emerges upon band inversion.

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Date submitted: 20 Nov 2016 Electronic form version 1.4