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Tunable spin helical Dirac quasiparticles in HgTe surfaces CHANG LIU, GUANG BIAN, SU-YANG XU, ILYA BELOPOLSKI, Dept. of Physics, Princeton University, USA, HSIN LIN, Dept. of Physics, Northeastern University, USA, CHRISTIAN MATT, Swiss Light Source, Paul Scherrer Institut, Switzerland, IREK MIOTKOWSKI, Dept. of Physics, Purdue University, USA, NASSER ALIDOUST, MADHAB NEUPANE, Dept. of Physics, Princeton University, USA, ROBERT S. MARKIEWICZ, ARUN BANSIL, Dept. of Physics, Northeastern University, USA, VLADIMIR N. STROCOV, Swiss Light Source, Paul Scherrer Institut, Switzerland, MARK BISSEN, Synchrotron Radiation Center, University of Wisconsin-Madison, USA, ALEXEI V. FEDOROV, Advanced Light Source, Lawrence Berkeley National Laboratory, USA, TAICHI OKUDA, Hiroshima Synchrotron Radiation Center, Hiroshima University, Japan, YONG P. CHEN, Dept. of Physics, Purdue University, USA, M. ZAHID HASAN, Dept. of Physics, Princeton University, USA — We show with photoemission spectroscopy that bulk HgTe is a topologically nontrivial material, possessing a Dirac-cone surface state with clear, unmodulated, left-right imbalanced spin polarization and circular dichroism. This topological surface state maintains its surface character even within the bulk continuum due to topological protection, in drastic contrast with ordinary solid where a surface band usually extends into the bulk and loses its surface character when it degenerates in energy with a bulk state. The Dirac transport regime of HgTe, where the topological surface state is fully exposed and free from influences of the bulk bands, can be easily reached by alkali metal deposition onto the surface.

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