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Coupling superconductors to topological insulators MENNO VELDHORST, MARCEL HOEK, MARIEKE SNELDER, Faculty of Science and Technology and MESA+ Institute for Nanotechnology, University of Twente, the Netherlands, XIAOLIN WANG, Institute for Superconducting and Electronic Materials, University of Wollongong, Wollongong, NSW, Australia, HANS HILGENKAMP, ALEXANDER BRINKMAN, Faculty of Science and Technology and MESA+ Institute for Nanotechnology, University of Twente, the Netherlands — The recent discovery of the topological insulators sparked an enormous attention. The experimental investigation of topological insulators with surface sensitive spectroscopic techniques evidently exposed the helical Dirac fermions living at the surface of a bulk insulator. In transport experiments, intrinsic bulk conduction challenges the observation of the topological surface states. We have observed electrical transport through the surface states of Bi_2Te_3 by utilizing the electrical field effect and by utilizing intrinsically transparent interfaces to metallic electrodes. Of particular interest is coupling topological insulators to superconductors, where at the interface the elusive Majorana fermion is predicted to reside. We fabricated superconductor – topological insulator – superconductor Nb- Bi_2Te_3 -Nb junctions and observed a supercurrent over a length scale of more than a micrometer. Shapiro steps appear under microwave irradiation. The supercurrent is found to be surprisingly robust in large magnetic fields.

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