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Photo-induced Chiral Edge Current in the 3D Topological Insulator Bi_2Se_3 RICKY ROY, University of Washington, MAO LI, Washington State University, GRANT AIVAZIAN, University of Washington, WANG YAO, University of Hong Kong, DAVID COBDEN, University of Washington, CHUANWEI ZHANG, Washington State University, XIAODONG XU, University of Washington — We perform scanning photocurrent (PC) microscopy measurements on the 3D topological insulator Bi_2Se_3, and observe spatially separated PC peaks of opposite sign, localized along the sample edges. The physics origin of this experimentally observed two-way PC is attributed to the chiral nature of the TI surface states. We show that the coupling between the optical field and the topological surface states yields a spin population imbalance along the edges of the surface, leading to the first order chiral edge charge current observed in the experiment. Further experimental observations of the weak polarization and strong temperature dependence of the PC agree with the theoretical predications. The PC fades away at a low temperature indicating a mean-free path of ~ 3 μm for topologically protected surface spins.

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