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Band structure engineering by disorder at a topological insulator surface[1] YISHUAI XU, JANET CHIU, LIN MIAO, HAOWEI HE, New York Univ NYU, ZHANYBEK ALPICHSHEV, Massachusetts Institute of Technology, Department of Physics, AHARON KAPITULNIK, Department of Physics, Stanford University, RUDRO R. BISWAS, Department of Physics and Astronomy, Purdue University, L. ANDREW WRAY, New York Univ NYU — Three-dimensional topological insulators (TI) are bulk insulators with Z2 topological order that give rise to Dirac surface states. These states are well protected against localization from perturbations that do not break time reversal symmetry, such as lattice disorder. However, recent studies show that even without localization, lattice disorder can change electronic states near the Dirac point dramatically, making ring-shaped resonance states near defects. I will talk about new results in which we have compared the form of these defects seen by STM with modeling results for randomly distributed scalar potential defects at a TI surface. We find that at typical defect densities for M2X3 TIs, coherent propagation of electrons between defect related resonance states can give rise to an emergent electron gas that supports diffusive electrical transport in a narrow range of energies near the Dirac point.

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