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Screening and atomic-scale engineering of the potential at a topological insulator surface PETER LOEPTIEN, LIHUI ZHOU, JENS WIEBE, ALEXANDER AKO KHAJETOORIANS, University of Hamburg, JIANLI MI, BO BRUMMERSTEDT IVERSEN, PHILIP HOFMANN, Aarhus University, ROLAND WIESENDANGER, University of Hamburg — The electrostatic behavior of the prototypical three-dimensional topological insulator $Bi_2Se_3(111)$ is investigated by a scanning tunneling microscopy (STM) study of the distribution of Rb atoms adsorbed on the surface. The positively charged ions are screened by both free electrons residing in the topological surface state as well as in the quantum well states induced by band bending of the conduction band, leading to a surprisingly short screening length and small dielectric constant. Combining a theoretical description of the potential energy with STM-based atom manipulation, we demonstrate the ability to create tailored potential landscapes for the Dirac electrons with atomic-scale control.

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