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Real-space imaging of Dirac-Landau orbits in Bi2Se3 YINGSHUANG FU, MINORU KAWAMURA, RIKEN CEMS, KYUSHIRO IGARASHI, Tokyo Institute of Technology, HIDENORI TAKAGI, University of Tokyo, Max-Planck-Institute, TETSUO HANAGURI, RIKEN CEMS, TAKAO SASAGAWA, Tokyo Institute of Technology — Dirac wave function has two-component spinors, which is associated with pseudo-spins in graphene and real spins in the surface state of topological insulators. To date, its direct observation is still elusive. Here we demonstrate it manifests itself in the Landau orbits drifting in a Coulomb potential. We perform spectroscopic imaging scanning tunneling microscopy on the topological surface state of Bi2Se3 to reveal the energy and spatial structures of Landau orbits. Our observations are qualitatively different from those reported in a conventional massive electron system but are well reproduced by a model based on a two-component Dirac Hamiltonian. Our model further predicts energy-dependent nontrivial spin textures in a Coulomb potential, providing a unique way to manipulate spins in the topological surface state.

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