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Quantum tunneling between Chern states in a Topological Insulator[1] MINHAO LIU, WUDI WANG, Princeton Univ, ANTHONY R. RICHARDELLA, ABHINAV KANDALA, Pennsylvania State Univ, JIAN LI, ALI YAZDANI, Princeton Univ, NITIN SAMARTH, Pennsylvania State Univ, N. P. ONG, Princeton Univ — The tunneling of a macroscopic object through a barrier is a quintessentially quantum phenomenon important in field theory, low-temperature physics and quantum computing. Progress has been achieved in experiments on Josephson junctions, molecular magnets, and domain wall dynamics. However, a key feature - rapid expansion of the true vacuum triggered by a tunneling event is virtually unexplored. Here we report the detection of large jumps in the Hall resistance Ryx in a magnetized topological insulator which result from tunneling out of a metastable topological state. In the TI, the conducting electrons are confined to surface Dirac states. When magnetized, the TI enters the quantum anomalous Hall insulator state in which Ryx is strictly quantized. If the magnetic field is reversed, the sample is trapped in a metastable state. We find that, below 145 mK, Ryx exhibits abrupt jumps as large as one quantum unit on time-scales under 1 ms. If the temperature is raised, the escape rate is suppressed consistent with tunneling in the presence of dissipation. The jumps involve expansion of the thermodynamically stable state bubble over macroscopic lengths, but dissipation limits the final size. The results uncover novel effects of dissipation on macroscopic tunneling.

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