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Mapping the unconventional orbital texture in topological crystalline insulators ILIJA ZELJKOVIC, Boston College, YOSHINORI OKADA, WPI-AIMR, Tohoku University, CHENG-YI HUANG, National Sun Yat-sen University, R. SANKAR, National Taiwan University, DANIEL WALKUP, WENWEN ZHOU, Boston College, MAKSYM SERBYN, Massachusetts Institute of Technology, FANGCHENG CHOU, National Taiwan University, WEI-FENG TSAI, National Sun Yat-sen University, HSIN LIN, National University of Singapore , ARUN BANSIL, Northeastern University, LIANG FU, Massachusetts Institute of Technology, M. ZAHID HASAN, Princeton University, VIDYA MADHAVAN, Boston College — The newly discovered topological crystalline insulators (TCIs) harbor a complex band structure involving multiple Dirac cones. These materials are potentially highly tunable by external electric field, temperature or strain and could find future applications in field-effect transistors, photodetectors, and nano-mechanical systems. Theoretically, it has been predicted that different Dirac cones, offset in energy and momentum-space, might harbor vastly different orbital character, a unique property which if experimentally realized, would present an ideal platform for accomplishing new spintronic devices. In this study, we unveil the orbital texture in a prototypical TCI $Pb_{1-x}Sn_xSe$ by using Fourier-transform (FT) scanning tunneling spectroscopy (STS) to measure the interference patterns produced by the scattering of surface state electrons. We discover that the intensity and energy dependences of FTs show distinct characteristics, which can directly be attributed to orbital effects. Our experiments also reveal the complex band topology involving two Lifshitz transitions.

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