Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Visualization of surface states in the putative weak and crystalline topological insulator Bi_2TeI NURIT AVRAHAM, Weizmann Institute of Science, Israel, ANDREW NORRIS, Institute IMDEA Nanoscience, Madrid Spain, LIN PAN, SHU-CHUN WU, CLAUDIA FELSER, BINGHAI YAN, Max Planck Institute for Chemical Physics of Solids, Dresden Germany, HAIM BEIDENKOPF, Weizmann Institute of Science, Israel, WEIZMANN ATOMIC SCALE PHYSICS LAB / WEIZMANN INSTITUTE OF SCIENCE, ISRAEL TEAM, MAX PLANCK INSTITUTE FOR CHEMICAL PHYSICS OF SOLIDS, DRESDEN GERMANY TEAM — Weak topological insulators (TI) are layered materials that possess surfaces with an even number of Dirac cones and surfaces that are fully gapped. This anisotropy provides them with unique properties such as sensitivity to the parity of the number of layers and absence of localization of their surface states. We use scanning tunneling microscopy to study the topological properties of stacked Bi_2TeI, a promising candidate for weak TI. We find 1D edge states at the boundaries of terraces perpendicular to the stacking direction, which are consistent with topological surface states on the side surfaces. However on top of the terraces, where the density of states (DOS) is expected to vanish, we observe non-zero DOS showing that the surface is in fact gapless. These findings are supported by recent theoretical calculations showing that this surface hosts topological surface states that are protected by Mirror symmetry, making the weak TI also a crystalline TI. The rich structure of quasi 2D terraces and Islands obtained on such cleaved Bi_2TeI surfaces provides an excellent playground to explore some of the most fundamental concepts of TIs.

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Date submitted: 10 Nov 2016 Electronic form version 1.4