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Local Magnetic Imaging of Proximity Effect-Induced Superconductivity at the Bi_2Se_3-Nb Interface PHILIP KRATZ, JOHN KIRTLEY, ILYA SOCHNIKOV, PHILLIP WU, ERIC SPANTON, KRISTIE KOSKI, YI CUI, ROBERT HAMMOND, MALCOLM BEASLEY, KATHRYN MOLER, Stanford University, USA — The interface between a topological insulator (TI) and an s-wave superconductor (SC) is predicted to host Majorana bound states analogous to vortices in a spinless p_x+ip_y superconductor. For 3D TIs coupled to s-wave superconductors, the winding of the superconducting vortices can counteract the TI pi-Berry's phase, resulting in zero-energy Majorana fermion excitations at the interface. Transport measurements of Bi_2Se_3 and Bi_2Te_3 superconducting junctions have shown Josephson junction effects[1,3,4] and established the existence of a supercurrent that is tunable with gate voltage [2], but the relative contributions of the bulk and bound states to the supercurrent is not well-understood. We report on measurements of the local superfluid density at the interface between Bi_2Se_3 nanoplatelets and Nb using a scanning SQUID microscope and quartz tuning fork sensor for simultaneous AFM characterization. We demonstrate that the local penetration depth measurements have increased accuracy and provide an experimentally tractable method for studying proximity effect-induced superconductivity at the SC-TI interface, which is a precursor for observation of the elusive Majorana fermion in Bi_2Se_3 and other 3D TIs.

[1] arXiv:1209.5830 (2012). [2] Nat. Comm. **2** (2011). [3] Nat. Mat. **11**, 421 (2012). [4] Phys. Rev. Lett. **109**, 056803 (2012). [5] Phys. Rev. B **84**, 165120 (2011).

Philip Kratz
Stanford University

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