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Study of proximity effect in superconductor - topological insulator heterostructures by scanning SQUID microscope ILYA SOCHNIKOV, ANDREW J. BESTWICK, JAMES R. WILLIAMS, THOMAS M. LIPPMAN, ANDREW S. BLEICH, JAMES G. ANALYTIS, IAN R. FISHER, DAVID GOLDHABER-GORDON, JOHN R. KIRTLEY, KATHRYN A. MOLER, Stanford University — A proximity induced superconducting state in topological insulators is potentially an enabling condition for exotic forms of superconductivity that may support Majorana fermions in some geometries. Initial studies of induced superconductivity in topological insulators have relied on transport measurements. We present a different contactless characterization approach based on a scanning SQUID microscope. We characterized Al superconducting rings with Josephson junctions made of Bi_2Se_3, long Al/Bi_2Se_3/Al Josephson junctions, and Bi_2Se_3/Al dots. We observe both induced proximity and inverse proximity effects in these heterostructures. Each of the structures provides unique information about the proximity effect, such as the critical current, the magnetic field penetration depth, and the critical temperatures of the induced superconducting state. These measured parameters allow the determination of limits on contributions from the surface and the bulk to the proximity effects in the topological insulator Bi_2Se_3.

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