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Non-contact current-phase measurements of topological weak links with scanning SQUID C.A. WATSON, I. SOCHNIKOV, J.R. KIRTLEY, K.A. MOLER, Stanford University, M. DENG, W. CHANG, P. KROGSTRUP, T.S. JESPERSEN, J. NYGARD, C.M. MARCUS, University of Copenhagen, L. MAIER, C. GOULD, G. TKACHOV, E.M. HANKIEWICZ, C. BRÜNE, H. BUHMANN, L.W. MOLENKAMP, University of Würzburg — Topological superconductivity has recently generated substantial interest as a pathway to Majorana physics in the solid state. Experimental efforts have focused on the superconducting proximity effect in topologically non-trivial junctions, but proof of the topological nature of the induced superconductivity remains elusive. We employ scanning superconducting quantum interference device (SQUID) susceptometry to study conventional superconducting Nb rings interrupted by weak links of 3D topological insulator HgTe and Al rings with InAs nanowire junctions. Varying the flux through each ring, we directly measure the current-phase relation (CPR) of the junction. Forward skewness in the CPR of 3D-HgTe which persists even in junctions long compared to the mean free path suggests that helicity may play a role in the high transmittance of Andreev Bound States that carry the Josephson current. Progress in InAs nanowire junction CPR measurements is also discussed. These measurements showcase the CPR as a fundamental characteristic of superconducting weak links and establish scanning SQUID microscopy as a powerful probe for performing such measurements.

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