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Unexpected Zero Bias Conductance Peak on the Topological Semimetal Sb(111) YAU CHUEN YAM, Harvard University and Univerisity of British Columbia, SHIANG FANG, PENGCHENG CHEN, Harvard University, MOHAMMAD HAMIDIAN, Harvard University and University of California, Davis, YANG HE, Harvard University, DILLON GARDNER, YOUNG LEE, Massachusetts Institute of Technology, BERTRAND HALPERIN, Harvard University, JENNIFER HOFFMAN, Harvard University and Univerisity of British Columbia
— The expected signature of the long-sought Majorana fermion in a heterostructure of a superconductor and a topological material is a zero bias conductance peak (ZBCP). We use scanning tunneling microscopy (STM) to image the cleaved surface of the topological semimetal antimony (Sb), whose long surface-state lifetime and small critical thickness make it a good candidate for building such heterostructures. Its bilayer crystal structure is expected to cleave between bilayers, however we observed step heights corresponding to the intra-bilayer distance, indicating the presence of a broken bilayer on some terraces. The dI/dV spectra observed on these abnormal terraces are quite different from the usual Sb spectra and there is a pronounced ZBCP. Using quasiparticle interference imaging, Landau level spectroscopy and density functional theory, we found that the ZBCP originates from a van Hove singularity in the band structure due to the broken layer. We acknowledge funding from the National Science Foundation grant DMR-1410480 and the Canada Excellence Research Chair program.

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