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Edge Josephson junction detection of topological chiral edge current in spin-triplet superconductor Sr_2RuO_4 with a calibrated sensitivity
BRIAN ZAKRZEWSKI, ALEX YING, Pennsylvania State University, JIAN-JIAN GE, ZHIQIANG MAO, Tulane University, YING LIU, Pennsylvania State University, Shanghai Jiao Tong University — Sr_2RuO_4 , a spin-triplet, odd-parity superconductor, is predicted to possess a chiral p -wave order parameter. A major consequence of this doubly degenerate state is the presence of chiral edge currents, domains, and domain walls. Direct evidence for these effects is still lacking. Using a Josephson junction formed between Al and the edge of a thin Sr_2RuO_4 crystal prepared by mechanical exfoliation in conjunction with a bulk supercurrent that generates a field along the same direction of that generated by the chiral edge current, we are able to probe the local magnetic field at the edge of the crystal with a sensitivity that is improved by two orders of magnitude over work previously reported. The calibration is done using a custom-built magnet. We found a small non-zero offset in the magnetic flux response when the external field is zero, signaling the existence of an intrinsic field at the edge. We compare our results to those predicted in various theoretical models, in particular, the recent theoretical work on scenarios in which the chiral edge current in Sr_2RuO_4 first calculated by Matsumoto and Sigrist can be suppressed.

Brian Zakrzewski
Pennsylvania State University

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