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The transport mechanism of supercurrents in the quantum Hall regime MING-TSO WEI, CHUNG TING KE, ANNE DRAELOS, ANDREW SEREDINSKI, Duke University, IVAN BORZENETS, The University of Tokyo, KENJI WATANABE, National Institute for Materials Science, TAKASHI TANIGUCHI, National Institute for Materials Science, Japan, RUSSELL DEACON, Center for Emergent Matter Science, RIKEN, Japan, MICHIHISA YAMAMOTO, The University of Tokyo, YURIY BOMZE, Duke University, SEIGO TARUCHA, The University of Tokyo, FRANCOIS AMET, Appalachian State University, GLEB FINKELSTEIN, Duke University — Supercurrent through quantum Hall (QH) edge states has been observed in ballistic graphene Josephson junctions at fields up to 2 Tesla. This provides a novel platform to study exotic topological states such as Majorana fermions and parafermions. However, the transport mechanism of supercurrents in the QH regime is not yet fully understood. Here, we report the studies of supercurrents in the QH regime with different sample geometries. The radius of cyclotron orbits altered by magnetic field and junction channel length determine the number of carrier bounces at the sample edges. In addition, the propagation of electron-hole hybrid modes near the graphene-superconductor interface may also be related to the width of the device. It is important to understand the geometric effects in order to optimize the supercurrent through the QH edge states. These studies would help us design better devices for ultimately detecting supercurrents through symmetry-breaking states.

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