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Progress in realizing topological superconductivity in planar Josephson junctions

Topological superconductivity hosts exotic quasi-particle excitations including Majorana bound states which hold promise for fault-tolerant quantum computing. The theory predicts emergence of Majorana bound states is accompanied by a topological phase transition. We show experimentally in epitaxial Al/InAs Josephson junctions a transition between trivial and topological superconductivity. We observe a minimum of the critical current at the topological transition, indicating a closing and reopening of the superconducting gap induced in InAs, with increasing magnetic field. By embedding the Josephson junction in a phase-sensitive loop geometry, we measure a π-jump in the superconducting phase across the junction when the system is driven through the topological transition. We discuss the next steps toward fusing two pair of Majoranas. These findings reveal a versatile two-dimensional platform for scalable topological quantum computing.