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Superconducting Edge-Mode Transport in InAs/GaSb Double Quantum Wells[1]

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In proximity to a superconductor, topological insulators are predicted to host topological superconductivity, an exotic state of matter that supports Majorana zero-modes. Localized Majorana modes are expected to obey non-Abelian exchange statistics, making them interesting building blocks for topological quantum computing. Here we report supercurrent in the edge modes of Type-II InAs/GaSb quantum wells, a two-dimensional topological insulator (2D TI). By electrostatically-gating the devices we observe superconducting transport in all three regimes of the 2D TI: bulk electrons, edge modes and bulk holes. From superconducting quantum interference measurements, we extract the spatial distribution of the supercurrent in each regime. A clear transition to edge-dominated supercurrent is observed under conditions of high bulk resistivity, which we associate with the 2D topological phase. These experiments establish InAs/GaSb as a promising platform for confinement of Majoranas into localized states, enabling future investigations of non-Abelian statistics.

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