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Majorana mode in vortex core of $Bi_2Te_3/NbSe_2$ topological insulator-superconductor heterostructure JINFENG JIA, Department of Physics and Astronomy, Shanghai Jiao Tong University — Majorana fermions have been intensively studied in recent years for their importance to both fundamental science and potential applications in topological quantum computing. Majorana fermions are predicted to exist in a vortex core of superconducting topological insulators. However, they are difficult to be distinguished experimentally from other quasiparticle states for the tiny energy difference between Majorana fermions and these states, which is beyond the energy resolution of most available techniques. Here, we overcome the problem by systematically investigating the spatial profile of the Majorana mode and the bound quasiparticle states within a vortex in $Bi_2Te_3/NbSe_2$. While the zero bias peak in local conductance splits right off the vortex center in conventional superconductors, it splits off at a finite distance $\sim$ 20nm away from the vortex center in $Bi_2Te_3/NbSe_2$, primarily due to the Majorana fermion zero mode. While the Majorana mode is destroyed by reducing the distance between vortices, the zero bias peak splits as a conventional superconductor again. This work provides strong evidence of Majorana fermions and also suggests a possible route to manipulating them.

Jinfeng Jia
Department of Physics and Astronomy, Shanghai Jiao Tong University

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