

Qubits based on Majorana bound states in Kitaev chains

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We have realized Majorana bound states (MBS) in Kitaev chains consisting of a sequence of quantum dots separated by superconductors. The quantum dots are spin-polarized and connected to each other via tunneling as well as Cooperpair splitting, mediated by a sandwiched superconductor. At sweet spots in the parameter space of chemical potentials and (tunnel) coupling strengths, MBS arise at the two ends of the chain. The sweet spots grow in size when making the chain longer, expected to develop a topological superconducting phase for chains with five quantum dots or more.

We have experimentally studied chains from two to six quantum dots, observing an increased stability of the MBS. In devices with two chains coupled to each other, we have realized qubits where the basis states are parity states of occupying the chain with an even or odd number of particles. Ongoing studies focus on enhancing qubit stability.