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Conductance of a proximitized nanowire in the Coulomb blockade regime

LEONID GLAZMAN, Yale University

We build a quantitative theory of two-terminal conductance across finite-length segments of nanowires which are made superconducting by the proximity effect. In the presence of spin-orbit interaction, a proximitized nanowire can be tuned across the topological transition point by an applied magnetic field. Due to a finite segment length, electron transport is controlled by the discrete-charging effect, which gives rise to the Coulomb blockade. As the result, the linear conductance strongly depends on the gate voltage applied to the segment, exhibiting a periodic structure of maxima, known as Coulomb blockade peaks. Upon increasing of the magnetic field, the shape and magnitude of the Coulomb blockade peaks is defined, respectively, by Andreev reflection, single-electron tunneling, and – after the topological transition occurs – by resonant tunneling through the Majorana modes emerging after the transition. Our theory provides the framework for the analysis of recent experiments with proximitized nanowires, and identifies the signatures of the topological transition in the two-terminal conductance. The talk is based on research performed in collaboration with Bernard van Heck (Yale University) and Roman Lutchyn (Station Q, Microsoft Research).