Majorana bound state engineering via efficient real-space parameter optimization

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Résumé

Majorana bound states (MBS) hold significant promise in the quest to realize a fault-tolerant quantum computer. In spite of the large research effort in the last decade, little is known beyond a few analytically tractable cases on the role of inhomogeneous parameters, such as magnetic fields and electrostatic potential profiles, as a resource for engineering robust MBS. In this talk, I will present an efficient numerical method for the optimization of experimentally relevant parameters in (quasi-)one-dimensional inhomogeneous wires. The algorithm is based on an analogy between the Gradient Ascent Pulse Engineering (GRAPE) algorithm used in quantum control and the Recursive Green's Function (RGF) method employed in quantum transport. The optimization operates on a largely unexplored parameter space and identifies new parameter regimes for the emergence of robust Majorana bound states, leading to new insights for the design of MBS experiments.

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