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Title:

Majorana fermion exchange in strictly one dimensional structures

Abstract:

It is generally thought that adiabatic exchange of two identical particles is impossible in one spatial dimension. Here we describe a simple protocol that permits adiabatic exchange of two Majorana fermions in a one-dimensional topological superconductor wire. The exchange relies on the concept of "Majorana shuttle" whereby a π domain wall in the superconducting order parameter which hosts a pair of ancillary Majoranas delivers one zero mode across the wire while the other one tunnels in the opposite direction. The method requires some tuning of parameters and does not, therefore, enjoy the full topological protection. The resulting exchange statistics, however, remains non-Abelian for a wide range of parameters that characterize the exchange.