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Non-abelian anyons and topological quantum information processing in 1D wire networks

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Topological quantum computation provides an elegant solution to decoherence, circumventing this infamous problem at the hardware level. The most basic requirement in this approach is the ability to stabilize and manipulate particles exhibiting non-Abelian exchange statistics – Majorana fermions being the simplest example. Curiously, Majorana fermions have been predicted to arise both in 2D systems, where non-Abelian statistics is well established, and in 1D, where exchange statistics of any type is ill-defined. An important question then arises: do Majorana fermions in 1D hold the same technological promise as their 2D counterparts? In this talk I will answer this question in the affirmative, describing how one can indeed manipulate and harness the non-Abelian statistics of Majoranas in a remarkably simple fashion using networks formed by quantum wires or topological insulator edges.