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Topological states in normal and superconducting p-wave chains[1]
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We study a two-band model of fermions in a 1d chain with an antisymmetric hybridization that breaks inversion symmetry. We find that for certain values of its parameters, the sp-chain maps formally into a p- wave superconducting chain, the archetypical 1d system exhibiting Majorana fermions. The eigenspectra, including the existence of zero energy modes in the topological phase, agree for both models. The end states too share several similarities, such as the behavior of the localization length, the non-trivial topological index and robustness to disorder. However, we show that the excitations in the ends of a finite sp chain are conventional fermions though endowed with protected topological properties. Our results are obtained by a scattering approach in a semi-infinite chain with an edge defect treated within the T-matrix approximation. We present exact numerical diagonalization results that extend our analysis to arbitrary parameters and to disordered systems. Finally, we show that the charge stiffness has a universal value at the topological transition of the sp-chain.

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