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Wavefunction oscillations and fermion parity crossings in disordered Majorana wire SURAJ HEGDE, SMITHA VISHVESHWARA, Univ of Illinois - Urbana — We study aspects of decay and oscillations of Majorana wavefunctions in one dimensional topological superconducting chains, by employing Majorana transfer matrix technique. The phase transition separating the trivial phase and the topological phase associated with the Majorana end modes can be traced to the cancellation of the two parts (superconducting and normal) of the Lyapunov exponent of the transfer matrix. We find that the Majorana oscillations and related fermion parity flips can be completely determined by an underlying non-superconducting tight-binding model. Using this observation we pinpoint the behavior of Majorana mode oscillations within the topological phase diagram. For a disordered wire, these band oscillations are completely washed out, leading to a second localization length for the Majorana mode. The remnant oscillations are however manifested and completely randomized by disorder effects. As a result, the associated fermion parity flips depend heavily on the average of the disorder distribution and the number of lattice sites of the chain. We show that the transfer matrix technique offers a simple way of understanding the known log-normal distribution of mid-gap Majorana states.

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