Characterization of low-energy states in Kitaev chains

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Majorana bound states (MBS) are quasiparticles with non-Abelian statistics, making them highly attractive for both fundamental research and applications in quantum computing. The Kitaev model predicts the emergence of these states at the ends of a chain under specific parameter conditions [1]. In experimental realizations, artificial Kitaev chains can be engineered using quantum dot (QD) – superconductor arrays [2,3], see Figure 1 for a sketch. Recently, a minimal two-site version of such a chain has been demonstrated, revealing the possibility of non-topological MBSs appearing at specific points [4].

Characterizing the emergent MBSs is a key challenge in the field, crucial for advancing towards robust quantum applications. In this presentation, I will introduce various methods for qualitatively and quantitatively identifying Majorana sweet spots through local measurements [5-8]. These measurements enable the identification of parameter regimes with high MBS localization, see Fig. 1(a), an essential step toward Majorana-based devices in Kitaev chains [9-11].

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Figures

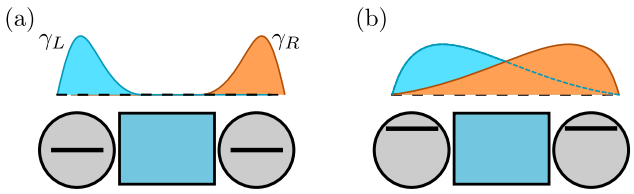

Figure 1: Sketch of a minimal Kitaev chain formed by two QDs coupled via a superconducting segment, hosting well-localized (a), and overlapping MBSs (b).