Impurity-induced excitations in twisted topological van der Waals superconductors

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Recent experiments demonstrated that twisted \text{CrBr}_3/\text{NbSe}_2 heterostructures provide a platform for artificial topological superconductivity. The emergence of a topological superconducting state in a twisted van der Waals material provides a new platform for exploring novel strategies to control topological superconductors, potentially exploiting unique features associated with a moire pattern. In particular, impurities in moire superconductors can potentially lead to the unique interplay between atomic and moire length scales, a feature absent in generic topological superconductors. Here we address the impact of non-magnetic impurities on a topological moire superconductor, both in the weak and strong regime, considering both periodic arrays and single impurities in otherwise pristine infinite moire systems. We demonstrate a fine interplay between impurity induced modes and the moire length, leading to radically different spectral and topological properties depending on the relative impurity location and moire lengths. Our results highlight the key role of impurities in topological moire superconductors, revealing the key interplay between length and energy scales in artificial moire systems.