Dynamics of vacancy-induced modes in the non-Abelian Kitaev spin liquid

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We study the dynamical response of vacancy-induced quasiparticle excitations in the site-diluted Kitaev spin liquid with a magnetic field. Due to the flux-binding effect and the emergence of dangling Majorana fermions around each spin vacancy, the low-energy physics is governed by a set of vacancy-induced quasi-zero-energy modes. These localized modes result in unique characteristics of the dynamical spin correlation functions, which intriguingly mimic the single-quasiparticle density of states and further exhibit a quasi-zero-frequency peak. By recognizing the potential observability of these local correlation functions via scanning tunneling microscopy (STM), we show how the STM response is sensitive to the local flux configuration, the magnetic field strength, and the vacancy concentration. Constructing a simple model of the localized modes, we also elucidate how the local correlation functions can be interpreted in terms of the hybridization between these modes.