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Distribution functions and probes of far-from-equilibrium topological matter[1] YUNXIANG LIAO, MATTHEW FOSTER, Rice University —
We investigate radio-frequency (RF) spectroscopy and superconductor-normal metal tunneling as probes of out-of-equilibrium topological systems. As an example, we study a 2D p+ip superfluid following an instantaneous quench of the coupling strength [Foster et al. PRB 2013, PRL 2014]. The long-time asymptotic order parameter of this system can be constant or time-periodic. In both cases, the post-quench Cooper pairs each occupy a linear combination of two states, with coefficients determined by the distribution function. In strong quenches where the order parameter is periodic, the bases are two Floquet states with opposite quasi-energy. We derive expressions for the RF and tunneling spectra for these post-quench states, examining both average values and harmonics. While the distribution function strongly affects the RF signal, it disappears from the tunneling spectrum. We show that the bulk RF signal obtained by occupying the lower Floquet band is dramatically different from that of the post-quench states. This is intimately related to the difference between the topology of the state, which cannot change under closed evolution, versus the topology of the non-equilibrium excitation spectrum. We also look for signatures of Majorana edge states in systems with an edge. We compute the local RF signal, which depends upon the non-equilibrium excitation spectrum of bulk and edge states as well as their occupation.

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