Unique signatures of topological phases in two-dimensional THz spectroscopy

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We address the microscopic theory for the two-dimensional optical spectroscopy of one-dimensional topological superconductors. We consider an archetypal topological superconductor in a ring geometry physically realizing periodic boundary conditions. This allows for bypassing energy-specific differences caused by topologically protected or trivial boundary modes that are hard to distinguish otherwise. In this way, the topological and trivial phase of the chain only differ by their bulk topologies. We present numerical and analytic results showing that the cross-peak structure of the 2D spectra carries unique signatures of the topological phases of the chain. Thus, our work reveals how 2D spectroscopy can identify topological phases in bulk properties.

[1] F. Gerken, T. Posske, S. Mukamel, and M. Thorwart, Phys. Rev. Lett. 129 (2022) 017401.