

The "Mode-Shell" correspondence, a unifying concept in topological physics

Abstract: In topological physics, the bulk-edge correspondence relates for example the chiral number of zero modes of a gapped 1D chiral Hamiltonian to a winding number in the Brillouin zone. Beyond this usual case, we explain that the chiral number of zero modes is topological as long as such modes are surrounded by a gapped region in phase space, like in continuous model or in higher-order insulators. In such cases, we establish a different correspondence where such an invariant is instead reexpressed as a (higher) winding number defined on the shell enclosing the modes in phase space.