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Equivalence of Different Limiting Bulk Spectra in Non-Hermitian Lattice Systems

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We address a long-standing problem in non-Hermitian materials: why spectral functions obtained under different boundary conditions, such as periodic and open boundaries, can appear drastically different even though they describe the same bulk system. We show that this apparent contradiction is only superficial. For a broad class of lattice models, all bulk spectral descriptions derived from large finite samples are physically equivalent in the bulk: they encode the same local response, the same propagation dynamics, and the same experimentally relevant bulk information. Thus, the bulk density of states is universal, even in the presence of strong boundary sensitivity and the non-Hermitian skin effect. We also show that the remaining differences between spectral descriptions are closely tied to the topology of an associated Hermitian doubled system, providing a simple physical perspective on when boundary-related spectral anomalies can arise. Using the Hatano-Nelson model as an illustrative example, we clarify how markedly different open- and periodic-boundary spectra can nevertheless represent the same bulk physics. These results resolve the old ambiguity of boundary-condition-dependent spectral functions in non-Hermitian systems and provide a clearer foundation for interpreting experiments and designing non-Hermitian materials.