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Exact expression of multifractal dimension on the non-Hermitian Cayley tree

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Multifractal analysis is a powerful tool for characterizing the localization properties of wave functions. Despite its utility, this tool has been predominantly applied to disordered Hermitian systems. Multifractal statistics associated with the non-Hermitian skin effect remain largely unexplored. Here, we demonstrate that the tree geometry induces multifractal statistics for the single-particle skin states on the Cayley tree by deriving the analytical expression of multifractal dimensions. This sharply contrasts with the absence of multifractal properties for conventional single-particle skin effects in crystalline lattices. Our work uncovers the unique feature of the skin effect on the Cayley tree and provides a novel mechanism for inducing multifractality in open quantum systems without disorder. [1] Phys. Rev. B 111, 075162 (2025) [2] Phys. Rev. B 111, 035144 (2025)

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