Pseudo-modes for bosons and fermions

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Pseudo-mode mappings of continuum environments to discrete modes have recently received new attention after earlier limitations to the method were overcome [1]. Here we summarize these improvements, focusing on the peculiar non-physical nature of some of the modes, and illustrate applications to zero and finite temperature open-quantum-system problems involving bosonic and fermionic environments. Comparisons to the hierarchical-equations-of-motion method [2] suggest pseudo-modes can be used to study a range of problems in many-body waveguide QED, quantum thermodynamics, light-harvesting in photosynthetic complexes, single-molecule electronics, and quantum control.

[1] N. Lambert, S. Ahmed, M. Cirio and F. Nori, Nature Communications 10, (2019), 3721.

[2] N. Lambert et al. arXiv preprint arXiv:2010.10806 (2020).