Dynamics of Open Systems Beyond the Wide-Band Limit:

A Linear-Scaling Approach

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Nonequilibrium heat transport in quantum systems coupled to wide-band embeddings provides a striking example of the limitations of the generalized Kadanoff-Baym ansatz (GKBA), while solving the full two-time Kadanoff-Baym equations remains computationally prohibitive. To address this challenge, an iterated solution to the reconstruction problem is proposed, resulting in a time-linear evolution scheme involving 14 correlators for systems with narrow-band embeddings. I will present a detailed derivation of the formalism, demonstrating that this approach eliminates artifacts associated with the GKBA and resolves convergence issues that arise in the wide-band limit. Furthermore, it enables the calculation of energy- and time-resolved currents, facilitating the modeling of heat flows in quantum systems and energy- and time-resolved photoemission experiments—all at significantly reduced computational cost.