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Hydrodynamic projection in Lindblad equations with Bogoliubov decoupled hierarchy

We consider open fermionic models with different types of dephasing noise in the framework of Lindblad equations. There exists a particular class of models, for which the Bogoliubov–Born–Green–Kirkwood–Yvon (BBGKY) hierarchy decouples. This makes it possible to obtain exact results, even though the models are interacting and there is no Wick's theorem for multi-point correlations (initial Gaussian density matrices do not remain Gaussian under time evolution).
We show that the equations of motion for n-particle Green's functions can be mapped onto n-particle imaginarily time Schroedinger equations with non-Hermitian Hamiltonians. We fully solve the one and two-particle cases, which enables us to describe linear response functions out of equilibrium. Models with particle number conserving jump operators exhibit a global U(1) symmetry, which leads to hydrodynamic behaviour at late times. Interestingly, it is possible to exactly determine the hydrodynamic modes, as well as the hydrodynamic projections of local operators.

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