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Driven-dissipative quantum many-body systems: From instability in cavity-boson systems to enhancement of superconductivity

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The driven-dissipative nature of quantum optical many-body systems is conventionally captured by the Lindblad form. It leads to substantial distinctions from their static counterparts described by the same effective Hamiltonian, including, for example, the dissipative instability towards high energy states in cavity-boson systems. The combination of the Floquet and Keldysh theories provide a more profound understanding of the underlying mechanism. The developed technique captures the most essential ingredient in the core of all these effects: the relative system-bath rotation, in a way far more comprehensive than the Lindblad form. Particularly, it can be straightforwardly applied to condensed matter systems, and reveals more intriguing and unexplored physics. Specifically in the Hubbard-Stratonovich mean-field description of superconductors, we predict the driven-dissipative enhancement of the superconducting gap at finite temperatures comparable to and beyond the critical temperature.

Abstract category

Quantum Optics

Primary authors: Dr RAMIRES, Aline (Paul Scherrer Institute); Dr CHITRA, R. (ETH Zurich); LIN, Rui (ETH Zurich)

Presenter: LIN, Rui (ETH Zurich)