Quantum field thermal machines

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Quantum systems undergoing out-of-equilibrium dynamics provide insights into how features of quantum statistical mechanics emerge. At the same time, they are thought to be relevant for notions in quantum thermodynamics, where quantum effects are expected to play a role in the understanding of the functioning of thermal machines operating in the nanoscopic realm. That said, for the latter, steps towards the realization of quantum thermal machines in which quantum many-body systems take center stage are quite painfully lacking. For the former, while the picture of quantum lattice systems has been becoming clearer, important questions are still widely open for quantum field systems. In this talk, we will have a look at a theoretical and experimental study of the dynamical emergence of Gaussian correlations in continuous quantum many-body systems [1], witnessed by new tomographic recovery techniques [3]. Building upon these efforts, we will discuss the blueprint for a quantum field thermal machine [2] for which first data are now being taken.

[1] Decay and recurrence of non-Gaussian correlations in a quantum many-body system, T. Schweigler, M. Gluza, M. Tajik, S. Sotiriadis, F. Cataldini, S.-C. Ji, F. S. Møller, J. Sabino, B. Rauer, J. Eisert, J. Schmiedmayer, Nature Physics 17, 559 (2021).

[2] Quantum field thermal machines, M. Gluza, J. Sabino, N. H. Y. Ng, G. Vitagliano, M. Pezzutto, Y. Omar, I. Mazets, M. Huber, J. Schmiedmayer, J. Eisert, PRX Quantum, in press (2021).

[3] Quantum read-out for cold atomic quantum simulators, M. Gluza, T. Schweigler, B. Rauer, C. Krumnow, J. Schmiedmayer, J. Eisert, Communications Physics 3, 12 (2020).