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Liouvillianity breaking in interacting Floquet-Lindblad systems under high-frequency drive

Kaoru Mizuta
Department of Physics, Kyoto University

Periodically-driven (Floquet) systems can host various phases inherent in nonequilibrium such as anomalous Floquet topological insulators and time crystals, and now they are recognized as one of the most important classes of nonequilibrium systems.
In Floquet systems under high-frequency drive, Floquet-Magnus (FM) expansion is a powerful tool to analyze their dynamics. In the case of closed Floquet systems, it dictates that their stroboscopic dynamics is understood by time-independent effective Hamiltonian (FM effective Hamiltonian) [1], but it also means that closed Floquet systems cannot host phenomena inherit in nonequilibrium in high-frequency regime.
We focus on dissipative Floquet systems under Markovianity, dominated by a time-periodic Liouvillian. In the dissipative cases under high-frequency drive, while the FM expansion again can describe their stroboscopic dynamics, it is a nontrivial and significant problem whether the dynamics is understood by time-independent effective Liouvillian (Liouvillianity). In our study, we have made an answer for generic systems with local interactions [2]. We have found that, while noninteracting systems can either preserve or break Liouvillianity of the FM expansion, generic interacting systems always show its breaking (Liouvillianity breaking) due to the spread of interactions. Our results imply that non-Markovianity emergently appears in the stroboscopic dynamics while the underlying Floquet systems are Markovian, or equivalently, that interacting Floquet-Lindblad systems do not have static Markovian counterparts even in high-frequency regimes in contrast to closed Floquet systems.
In the seminar, after introducing some fundamental notions of Floquet systems, I would like to discuss our study on Liouvillianity breaking in interacting Floquet-Lindblad systems.

[1] T. Kuwahara, T. Mori, and K. Saito, Annals of Physics 367, 96 (2016)
[2] K. Mizuta, K. Takasan, and N. Kawakami, arXiv:2008.13104 (2020)

Contact : T. Yoshida, 吉田恒也 Email: yoshida@rhodia.ph.tsukuba.ac.jp