凝縮系物理学ゼミナール
Condensed Matter Seminar

(※ seminar is held online via zoom)

Date: **13:30-15:00**, Wednesday, 24th June 2020

“Liouvillian Breaking in dissipative Floquet systems under high-frequency regimes”

Speaker:

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Abstract:

Periodically-driven (Floquet) systems have widely attracted much interest as nonequilibrium platforms with unique phenomena, such as Floquet engineering, Floquet topological phases, and Floquet time crystals.
In general, it is difficult to analyze Floquet systems due to their time-dependency. However, in closed Floquet systems under high-frequency drives, their dynamics is well captured by the Floquet-Magnus (FM) effective Hamiltonian, the perturbative expansion in the period T. Importantly, the FM effective Hamiltonian is a static Hamiltonian, which enables prethermalization in local many-body systems [1], and Floquet engineering of topological or ordered phases [2]. At the same time, this hermiticity implies that closed Floquet systems in high-frequency regimes always have counterparts in closed static systems.

On the other hand, dissipative Floquet systems described by a time-periodic Liouvillian also have the FM expansion in high-frequency regimes [3]. However, it is a nontrivial problem whether the FM effective Liouvillian is a Liouvillian, and hence it is unclear that we can utilize various notions accumulated in the context of static Liouvillian systems, such as the existence of steady states and the trajectory method, for such dissipative Floquet systems. In our study, we establish the way to judge whether the FM expansion is a Liouvillian, and apply it to few-body systems and many-body systems with local interactions [4]. We observe Liouvillian-breaking of the FM expansion for both cases, and that Liouvillian-breaking in many-body systems is essentially caused by locality of interactions and many-body property. Our

results will indicate that Floquet Liouvillian systems cannot be captured by static Liouvillian systems even in the high-frequency regimes unlike the closed cases.

References:

[1] T. Kuwahara, T. Mori, and K. Saito, Annals of Physics 367, 96 (2016)
[2] T. Oka and H. Aoki, Phys. Rev. B 79, 081406 (2009)
[3] C. M. Dai, Z. C. Shi, and X. X. Yi, Phys. Rev. A 93, 032121 (2016)
[4] K. Mizuta, K. Takasan, and N. Kawakami, in preparation.