凝縮系物理学ゼミナール
Condensed Matter Seminar

Location: **Room 413**, School of Science Bldg. 5 (理学 5 号館 413 号室)

Date: **<u>13:30-15:00</u>**, Wednesday, 19 December 2018

"Quantum Lyapunov spectrum and correlation matrix in strongly correlated quantum systems"

Speaker:

Masaki Tezuka (Condensed Matter Theory Group)

Abstract:

Recent progress in the study of the Sachdev-Ye-Kitaev (SYK) model and its variants have attracted renewed attention in the characterization and quantization of quantum chaotic dynamics. Experimental realization of the SYK model has been proposed in various atomic and solid condensed matter setups, [1] including a Majorana wire array coupled to a quantum dot and the surface of a 3D topological insulator covered with a superconductor film having an irregular-shaped hole.

We propose two quantities for characterization of quantum many-body chaos. Firstly, we define a simple quantum generalization [2] of the spectrum of finite-time classical Lyapunov exponents. [3] We study its statistical features for the SYK model and find random matrix behavior, which is lost when the model is deformed away from chaos towards integrability [4] by a random two-fermion term. Secondly, we propose that two-point correlation functions can also characterize quantum many-body chaos [5] with numerical evidences for the SYK model as well as for the XXZ spin chain with random field. Finally, we discuss the plausibility of laboratory experiments.

References:

[1] M. Franz and M. Rozali, Nature Reviews Materials **3**, 491 (2018).

[2] M. Hanada, H. Shimada, and M. Tezuka, Phys. Rev. E **97**, 022224 (2018).

[3] H. Gharibyan, M. Hanada, B. Swingle, and M. Tezuka, arXiv:1809.01671.

[4] A. M. Garcia-Garcia, B. Loureiro, A. Romero-Bermudez, and M. Tezuka, Phys. Rev. Lett. **120**, 241603 (2018).

[5] H. Gharibyan, M. Hanada, B. Swingle, and M. Tezuka, in preparation.