# 凝縮系物理学ゼミナール
# Condensed Matter Seminar

Date: 13:30-15:00, Wednesday, 15 June 2022

## Title: Quantum error correction in SYK-like models

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Abstract:

We have quantitatively studied the relationship between the chaotic dynamics by quantum many-body Hamiltonian and quantum error correction accuracy [1].

We have estimated the recovery error in the Hayden-Preskill protocol [2], which was proposed as a toy model for studying the black hole information loss problem from a quantum information theoretical viewpoint: For an old black hole entangled with much Hawking radiation, an observer with the knowledge of the details of the black hole and the previous radiation would be able to gain the knowledge on new quantum information thrown into the black hole just by collecting new radiation of a similar amount.This information recovery is due to the scrambling dynamics of the quantum chaotic black hole and can be regarded as an information theoretical characterization of scrambling. In this talk, we discuss the cases of the Sachdev-Ye-Kitaev model and its two variants, namely the SYK4+2 model [3], in which the chaotic behavior is suppressed, and a version [4] of the sparse SYK model [5] where the absolute value of the couplings is a constant.

[1] Y. Nakata and M. Tezuka, in preparation.
[2] P. Hayden and J. Preskill, JHEP 0709, 120 (2007) [arXiv:0708.4025]; see also B. Yoshida and A. Kitaev, arXiv:1710.03363.
[3] see e.g. A. M. García-García, B. Loureiro, A. Romero-Bermúdez, and M. Tezuka, Phys. Rev. Lett. 120, 241603 (2018) [arXiv:1707.02197]; F. Monteiro, T. Micklitz, M. Tezuka, and A. Altland, Phys. Rev. Research 3, 013023 (2021) [arXiv:2005.12809]; F. Monteiro, M. Tezuka, A. Altland, D. A. Huse, and T. Micklitz, Phys. Rev. Lett. 127, 030601 (2021) [arXiv:2012.07884].
[4] M. Tezuka et al., in preparation.
[5] B. Swingle, talk at Workshop: Applications of Random Matrix Theory to Many-Body Physics (2019); S. Xu, L. Susskind, Y. Su, and B. Swingle, arXiv:2008.02303; A. M. García-García, Y. Jia, D. Rosa, and J. J. M. Verbaarschot, Phys. Rev. D 103, 106002 (2021) [arXiv:2007.13837].