Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Fast scrambling in a one-dimensional spin chain without random long range interactions[1] SAYAN CHOUDHURY, ZEHAN LI, W. VINCENT LIU, Univ of Pittsburgh — Scrambling is a dynamical process characterizing how locally stored quantum information becomes inaccessible to local measurements during the time evolution of a quantum many-body system. Fast scrambling is of fundamental importance due to its relation to quantum chaos, thermalization, and holographic duality. Most studies so far require random long range interactions to enable fast scrambling. So, a fundamental question is whether such a class of interactions is crucial for fast scrambling. In this work, we propose a new spin chain model, which exhibits fast scrambling without randomness. The model has two ingredients- nearest neighbor interactions, and infinite range interactions. We find that these two ingredients are sufficient to realize fast scrambling. We quantify the scrambling rate using out-of time-ordered correlators, and show that fast scrambling can be observed over a wide parameter regime. We also discuss how to realize our model in current experimental setups.

[1]AFOSR Grant No. FA9550-16-1-0006 and the MURI-ARO Grant No. W911NF17-1-0323

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Date submitted: 29 Jan 2020 Electronic form version 1.4