RICE QUANTUM GROUP MEETING SEMINAR SERIES

Date: June 24, 2022, Friday

Time: 3PM - 4PM

Venue: SST 300

Research Group: Prof. Andriy Nevidomskyy's Group

Presenter: **Dr. Han Yan**

Title: **Higher-rank U(1) spin liquid by design, with experimental applications**

Abstract: Fracton-related phases of matter have attracted tremendous attention in recent years. Compared to the exciting progress on the theoretical side, experimental realizations are still rare. In this talk, we discuss two approaches to construct classical higher-rank U(1) spin liquid: 1. via manipulating multiple copies of conventional U(1) spin liquid [1] and 2. via higher-rank vortex-charge duality [2]. On the theory side, these results lend us insights into a more general program of classifying classical spin liquids. On the experimental front, some of our constructions are highly realistic: there are known materials [3,4] that have interactions very close to our ideal models.

[1] H Yan, et al., PRL 124, 127203 (2020). [2] H Yan, J Reuther, PRR 4 (2), 023175 (2022)
[3] C. Balz, et al., Nature Physics 12, 942 (2016). [4] J. G. Rau, et al., PRL. 116, 257204 (2016).

Short Bio: Han received his B.S. degree in Physics at the University of Science and Technology of China, then graduated from the University of Cambridge with a Master's Degree of Advanced Study in Mathematics and Northwestern University with a Master's Degree in Physics. He obtained his Ph.D. in Physics from the Okinawa Institute of Science and Technology in Japan. His research interest revolves around the quantum physics of a complex system. As a Rice Academy Fellow and postdoc in the Department of Physics and Astronomy, he is working under the mentorship of Prof. Andriy Nevidomskyy to explore the world of "fractons" — bizarre particles in complex quantum systems that are immobile, and only move when they are grouped together. Behind the Fractons is a collection of exotic quantum physics, from intrinsically constrained dynamics to robust topological physics. For example, the Fracton matters can be used to build hard disks that can store quantum information — a critical step toward building a quantum computer. Another fascinating aspect of Fracton matter is that they seem to mimic quantum gravity — so with Fractons we might be able to build toy black holes in a laboratory. He finds it excited to investigate different frontiers of Fracton matters — from their profound theoretical implication to routes of their realization in experiments.

Note: *Snacks and Coffee will be served during the event.*