RICE QUANTUM GROUP MEETING SEMINAR SERIES

Presenter: **Aleksandra Nelson**

Research Group: Prof. Evelyn Tang's group

Date: September 29, 2023, Friday

Time: 4PM – 5PM

Venue: SST 300

Stochastic topological states require non-Hermiticity for strong edge localization

Abstract:

Topological phases of matter are characterized by a topological invariant, that can be observed as a localized mode on the edge of the system. This phenomenon is called bulk-boundary correspondence. Topological theory was initially developed for electrons in quantum materials, and in this talk I will explain how it can be extended to systems of stochastic particles moving over periodic lattices. Comparing how topological invariant manifests in quantum and stochastic systems, I will show that the latter breaks the bulk boundary correspondence, if it is described by a Hermitian matrix. This means that in order to get an edge-localized behavior, the stochastic system must be non-Hermitian, in other words assume non-reciprocal transition rates. I will show two ways, in which non-Hermiticity restores edge localization in topological stochastic systems: via the non-Hermitian skin effect, and via extension of its spectrum along imaginary axis in the complex plane. As stochastic processes are widespread in biological organisms, this project is a step towards searching for new biological mechanisms using tools from condensed matter.

Bio:

Aleksandra Nelson is a postdoctoral associate in the group of Prof. Evelyn Tang. She obtained her PhD degree at the University of Zurich under the supervision of Prof. Titus Neupert. During her PhD she worked in the field of topological condensed matter and contributed to the development of delicate topological insulators. In her current position she is applying methods of topological band theory to life matter. She is particularly interested in robustness of biological mechanisms under varying environmental conditions and plans to tackle these questions using the principles of topology.

Note: *Snacks and Coffee will be served during the event Wine & cheese will be served after the talk. Everyone is welcome to stay around after the seminar for further informal discussions.*