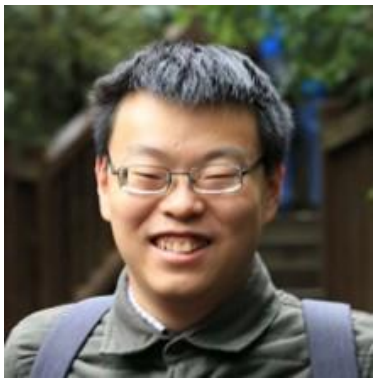
RICE QUANTUM GROUP MEETING SEMINAR SERIES



Presenter: **Haotian Wei**

Research Group: Prof. Kaden Hazzard's group

Date: November 3, 2023, Friday

Time: 4PM – 5PM

Venue: SST 300

Parameters and Algorithms for Programmable Fermi-Hubbard Tweezer Arrays for Quantum Simulations

***Abstract*:**

Understanding fermionic quantum many-body physics and complex chemical systems is important yet challenging given limitations from computational resources. Fermionic quantum simulators, e.g., recently realized programmable Fermi-Hubbard tweezer arrays, offer a promising approach to overcoming these limitations. However, to use these versatile experimental Fermi-Hubbard models as quantum simulators, it is crucial to know the Hubbard parameters describing them. Here I will present the methods we developed to calculate the Hubbard model parameters of arbitrary two-dimensional lattice geometries. One notable finding is that equally strong and separated tweezers give spatially non-uniform Hubbard parameters, and I will demonstrate procedures to find trap configurations that equalize these parameters. In addition, I will introduce further research on universality and efficiency in using these platforms to realize a fermionic variational quantum eigensolver. These findings underscore the potential of fermionic quantum simulations, paving the way for deeper insights and novel applications in and beyond quantum many-body physics.

***Bio*:**

Haotian Wei is a 4th year Ph.D. candidate in Dr. Kaden Hazzard's group in department of physics and astronomy. Prior to joining Rice, he earned his Bachelor of Science degree in Physics from Fudan University in Shanghai, China. Haotian's research explores the intersection of quantum many-body theory and the practical engineering of quantum simulation and computing platforms, with a particular focus on ultracold fermionic atoms. Using analytical and numerical tools, Haotian has been dedicated to developing novel fermionic quantum-classical hybrid algorithms, engineering programmable fermionic quantum simulators, understanding SU(N>2) Fermi-Hubbard physics, and investigating the equilibrium and non-equilibrium properties of quantum spin models.

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.