SACRAMENTO STATE

Department of Physics and Astronomy

SPRING 2024 Colloquium Series

“Idealistic Simulations of Multidimensional Quantum Many-body Systems”

Chevy Cecil

Sac State Physics Major

In recent years, computational condensed matter researchers have increasingly turned their attention to the potential of quantum computers in advancing their studies. While these researchers traditionally rely on simulations to analyze the properties of quantum many-body systems, the limitations of current hardware and the demand for faster data processing suggest a natural transition toward quantum computing. The rapid evolution of quantum hardware prompts a critical inquiry into its capabilities and whether it can effectively tackle complex and less explored condensed matter models.In 2019, a team at IBM embarked on a groundbreaking exploration to address this inquiry. Focusing on well-established 1-dimensional spin models, they demonstrated that with an appropriate mapping onto quantum computers, simulations and analyses of quantum many-body systems become feasible. This pivotal discovery marked a significant advancement in the realm of computational condensed matter physics, yet it primarily pertained to a narrow spectrum of researchers investigating single-dimensional systems. This project endeavors to push the boundaries of quantum computing's utility in condensed matter research by employing it to analyze established spin systems across multiple dimensions, encompassing variations in spin direction and lattice dimensionality. The methodology involves conducting comparative analyses between results obtained from quantum computer simulations and classical simulations of the same models. Through this comprehensive examination, insights into the efficacy of quantum computers in tackling multi-dimensional quantum many-body systems within condensed matter research will be gained.

***Tuesday, May 7, 2024**

4:00 - 5:20PM

MND1015

Open & Free to all students, faculty and public