Northwest Quantum Nexus Seminar Series

Understanding the Computational Power of Physics

Join us for a discussion on the role that quantum computing can play in formalizing the question, "What is the computational power of systems that obey the laws of quantum mechanics?" Nathan Wiebe will discuss how we can understand this power through asking two types of questions:

- What classes of problems could be solved by exploiting the natural physical laws of a system?
- What subset of physical law can be simulated in polynomial time on a quantum computer?

Nathan will review recent results from Hamiltonian complexity, which gives a formal relationship between computational complexity and the problem of preparing particular states of matter in physical system. He will discuss the recent work he and his collaborators have performed to solve the converse problem of understanding whether all reasonable physical processes can be simulated in polynomial time on a quantum computer. He will include a specific example of simulation of the Schwinger model and how this simulation method paves the way towards understanding whether the standard model of physics can be simulated in polynomial time on a quantum computer or whether a more general computational model is needed to understand the computational power of nature.

Hosted by the Northwest Quantum Nexus (NQN), a coalition led by the U.S. Department of Energy's Pacific Northwest National Laboratory, Microsoft Quantum, and the University of Washington. These web-based seminars feature experts on quantum computing and its applications, and support NQN's goal of creating a vibrant industry that will contribute to the economic vitality of the region. For questions, contact *diane.stephens@pnnl.gov*

Wednesday, October 21 | 3:00 p.m.

Teams Meeting

NATHAN WIEBE

Nathan Wiebe is a physicist at Pacific Northwest National Laboratory and an affiliate assistant professor in the department of physics at the University of Washington. His work focuses on quantum simulation algorithms, quantum machine learning and quantum optimization algorithms. In particular, his work has provided the first quantum algorithms for least-squares fitting and deep learning as well as discovery of linear-combinations of unitary simulation methods, the truncated Dyson series/interaction picture simulation algorithms and has led to the best known methods for simulating chemistry on quantum computers.