



Paul Kairys

Alvin M. Weinberg Fellow

Where and when did you earn your PhD?

I earned my PhD in energy science and engineering at the Bredesen Center of the University of Tennessee–Knoxville. I graduated in 2022.

What was the subject of your dissertation?

My dissertation was titled “Control and Calibration Strategies for Quantum Simulation” and focused primarily on developing approaches to utilizing controllable quantum devices to simulate real-world quantum mechanical phenomena—a task known as quantum simulation.

What was your dissertation’s major contribution to your field?

My graduate research laid out, and rigorously verified, how quantum devices can be programmed from an analog perspective to ensure highly efficient, application-specific quantum simulation. My work included demonstrations on actual quantum hardware as well as theory and computations.

Who is your ORNL mentor, and which group and division are you working in?

I am working in the Quantum Computational Science group of the Computing and Computational Sciences Directorate. The group is managed by Ryan Bennink, who is also my primary ORNL mentor.

Paul is also mentored by Matthew Stone, a neutron scattering scientist in the Direct Geometry group.

What will your fellowship research focus on?

My fellowship research focus is the integration of quantum sciences and neutron sciences. The research will develop quantum algorithms for neutron scattering and experimental design as well as assess the value of entanglement between neutrons.

What are your research interests?

I am interested in the development and application of unconventional computational approaches to accelerate scientific discovery in domains like material science, chemistry, and physics. I'm broadly interested in addressing challenging, interdisciplinary science problems within areas like quantum information and computation, autonomous science, and unconventional computing. I'm also interested in many fundamental domains like physics, computer science, and mathematics.

What led you to science and your specific discipline?

While studying for my bachelor's degree in chemical engineering, I began learning how to use mathematical models and computers to describe physical processes and how computers accelerate scientific discovery. I thought this was fascinating, but I also learned about all the problems that are just too hard to solve, even with the world's most powerful supercomputers. This eventually led to my interest in quantum computing and other unconventional computing paradigms and the fundamental sciences that underlie these emerging technologies.

What did you do before coming to ORNL?

Prior to ORNL, I was a postdoctoral researcher in the Mathematics and Computer Science Division at Argonne National Laboratory. While at Argonne, I worked with fantastic scientists on various research projects relating to quantum science and engineering.

Could you share an interesting fact or two about yourself?

Outside of work my wife, Hannah, and I enjoy antiquing, thrifting, and collecting art glass and pottery.

What nonscience topic or activity is important to you and why?

I'm very interested in mentorship because I've had many great mentors that have all helped me to succeed. Mentorship has given me new, valuable perspectives, and I believe that mentorship is mutually beneficial to both the mentor and mentee.

