Unlocking Quantum Potential

The MonArk Quantum Foundry Fabricates Missing Links

Dr. Hugh Churchill, a native Arkansan and a physicist with a Ph.D. from Harvard University, leads trailblazing research in the field of quantum technology, studying matter and energy at the level of single electrons. Before joining the University of Arkansas (UA) in 2015, he held a Pappalardo Fellowship at the Massachusetts Institute of Technology.

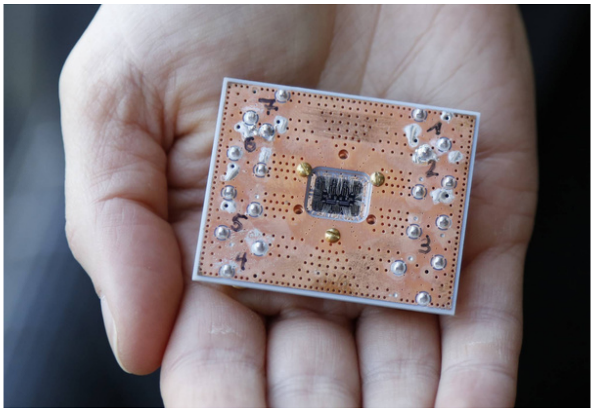
Hugh Churchill, PhD

Dr. Churchill leads the UA Quantum Device Lab and the Arkansas site of the MonArk National Science Foundation (NSF) Quantum Foundry, a partnership between UA and Montana State University, in pioneering quantum research and fabricating quantum devices. The team investigates how the physical properties of materials change when reduced to the atomic scale in one or more directions. This research could be revolutionary across industries, spanning artificial intelligence, medicine, agriculture, and more.

Quantum devices use quantum bits, "qubits," to perform some complex calculations faster than traditional computers. They hold the potential to transform computing, communication, and problem-solving across a wide range of fields, from cryptography to materials science. For example, quantum devices could revolutionize drug discovery by quickly and precisely simulating the behavior of complex molecules, speeding up the process of medication development.

The Challenge

The main challenge of advancing quantum technology with atomic scale materials and then applying its massive potential is the long process of making the materials, which involves growing thin layers of specific materials atom by atom, or even creating novel materials with specific quantum properties. The next step, fabricating electronic devices from them, requires precision and extensive testing, further lengthening the process.



The research community, especially in the heart of the country, has limited access to fabrication and measurement capabilities needed for quantum technology projects. Many of the tools and equipment needed for working with quantum materials and devices are highly specialized and expensive. Quantum research also requires very specific expertise.

Arkansas Research Alliance

The Solution

MonArk speeds up making quantum devices using robots and artificial intelligence to assemble super-thin 2D materials. To test the completed devices, the team has high-tech labs with ultra-low temperatures, and they mix physics, materials science, and electrical engineering to make and test super-small, high-performance quantum devices.

MonArk's goal is to eventually become fast enough that they can satisfy not only their own internal research needs but also serve a large national network of collaborators with quick access to the quantum materials and devices produced by MonArk. This national network and rapid access would catalyze innovation and accelerate the development of groundbreaking quantum applications across various fields, fostering collaboration and driving technological advancements.

Next Steps

The MonArk Foundry's next significant milestone is establishing a cleanroom facility for semiconductor device fabrication. A controlled environment is essential for accelerating quantum device production - even a tiny speck of dust can disrupt quantum device performance. UA has made significant investments to construct space for the cleanroom, but additional investment of around $1 million is needed for equipment to make this facility operational.

Churchill's Quantum Device Lab and the MonArk NSF Quantum Foundry are poised to make significant strides in quantum technology, impacting diverse industries, from artificial intelligence to agriculture. With a cleanroom facility as a crucial resource, the team is set to position the University of Arkansas at the forefront of quantum research.

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