

# Quantum Research

at Lawrence Livermore National Laboratory

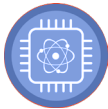
Creating quantum science capabilities to address tomorrow's mission challenges

At Lawrence Livermore National Laboratory (LLNL), our multidisciplinary research teams are harnessing the power of quantum technology to solve increasingly complex national security challenges.

## Research thrusts



**Computing**—creating new computing paradigms capable of solving research problems that state-of-the-art exascale computers cannot solve.



**Simulation**—enabling direct simulation of complex quantum phenomena, such as nucleon scattering and the physics of matter at extreme conditions.



**Sensing**—using highly precise sensing capabilities to image living cells, understand decoherence in qubits, and detect hidden objects.

## Why LLNL?

LLNL is home to some of the world's most powerful supercomputers, but even those powerful resources don't meet the increasing computational demands of our national security mission. Quantum technologies may be part of the solution. With this mind, we are exploring focused, application-specific quantum solutions. Examples include:

- Developing new materials and device fabrication techniques to produce superconducting quantum hardware.
- Leveraging LLNL's expertise in photon science to improve control of quantum systems.
- Enabling supercomputing resources to interface with quantum computers.
- Applying classical optimization for quantum control and signal processing to quantum sensors to improve system performance.

As we explore quantum-based solutions, we tap into the specialized knowledge of LLNL scientists who are experts in mission-critical research areas, such as nuclear physics, materials science, forensic science, high-power lasers, and exascale-enabled modeling and simulation.



Audrey Eshun is a quantum optics expert who joined LLNL as a postdoc before converting to a staff position in 2024. Audrey is exploring ways to use a quantum light source to capture 3D images of sensitive biological samples, including using the tool to study plant-microbiome interactions that play key roles in biofuel production.

LLNL's Quantum Design and Integration Testbed offers a state-of-the-art research environment for developing quantum processors and algorithms—offering whitebox access for testbed users. Device engineers and system developers work side-by-side with physicists and chemists to explore mission-relevant applications of quantum computing.

## Our teams

In our highly collaborative research environment, colleagues connect with LLNL specialists in multiple disciplines and leading scientists from other research institutions—enabling them to share resources, learn from each other, and identify solutions.

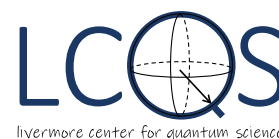
Our quantum research teams typically include physicists, materials scientists, photon scientists, and system engineers. They can easily access leading experts in software and algorithm development, hardware design, or predictive modeling.



Kyle Wendt joined LLNL as a Lawrence Fellow before converting to a staff position. In 2024, Kyle received an Early Career Research Program (ECRP) award from the U.S. Department of Energy. The award supports Kyle's research developing novel quantum computing algorithms that can be used to simulate nuclear reactions—capturing data that is difficult to measure in a lab, or by using traditional high-performance computing.

**The Livermore Center for Quantum Science** supports the thriving quantum research community at LLNL. The Center:

- Hosts seminars and workshops to inspire tomorrow's innovators.
- Fosters external collaborations that accelerate solutions.
- Develops our future quantum workforce through paid student internships.



Learn more  
[quantum.llnl.gov](https://quantum.llnl.gov)

Contact us  
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