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HIGHLIGHTING NEWS

QUERA USES AI TO AUTONOMOUSLY LOCK AND TUNE QUANTUM-COMPUTER LASERS

Reliable quantum computing depends not only on better qubits, but also on keeping the complex hardware around them continuously stable. QuEra Computing has demonstrated an AI-assisted control system that can autonomously recover and optimize the precision lasers used to operate its neutral-atom quantum computers—reducing interventions that once required an expert to travel to the laboratory.

The challenge lies in maintaining laser frequencies with extreme precision. Temperature changes, vibration, pressure, and electrical noise can push a laser away from its intended operating point or cause it to lock onto the wrong optical mode. While traditional feedback systems handle routine fluctuations, severe disturbances have historically required a laser specialist to diagnose the failure, sweep the system back toward the correct mode, and verify the result against an absolute wavelength reference.

To automate this process, QuEra deployed the Model Hardware Standard, or MHS, originally developed through a collaboration between Anthropic and the HHMI Janelia Research Campus. Working through MHS, the Claude AI model interacted with a dedicated laser testbed, proposed recovery strategies, tested them on live hardware, analyzed the results, and refined its approach under human-defined safety limits. The resulting production controller is a deterministic and fully inspectable program, meaning the AI is no longer required during routine relocking operations.

According to QuEra, the controller successfully restored the correct laser state in 695 of 700 validation trials, achieving a 99.3% recovery rate across seven disturbance classes. Most faults were resolved within 0.9 to 5.4 seconds, while the most difficult wavelength-changing failures took approximately 10 to 14 seconds—compared with five to ten minutes for a human expert. During normal laboratory operation, the system also detected and autonomously recovered from all 43 naturally occurring laser mode hops observed during the pilot.

The AI-based approach was also applied to laser optimization. By exploring approximately 12,500 combinations of twelve interacting feedback parameters, the system reduced residual frequency noise by a factor of five and completed a roughly 19-hour unattended test without a single lock drop, compared with a previous rate of 1.6 drops per hour. An independent measurement further showed that the automated configuration suppressed a previously hidden resonance near 220 kHz by roughly one thousandfold and improved a linewidth-related metric from 58 to 21 kHz.

The implications extend beyond a single laser subsystem. Future logical quantum computers may need to execute programs continuously for hours or days, meaning that even a brief hardware-control failure could invalidate an otherwise successful calculation. By turning specialist knowledge into autonomous, verified control systems, QuEra aims to improve uptime while reducing the expert labor required to build, commission, and operate quantum computers at scale. The project therefore represents an important proof point for using AI not merely to develop quantum algorithms, but to manage the physical infrastructure on which reliable quantum computation depends.

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NSF INVESTS $290 MILLION IN EIGHT QUANTUM RESEARCH INSTITUTES

The United States is making a major new investment in quantum science. The National Science Foundation has announced more than $290 million in funding for eight Quantum Leap Challenge Institutes, expanding a national research program focused on quantum computing, sensing, networking, simulation, and related technologies.

Three of the institutes are newly established, while five will receive renewed support to continue work launched through earlier NSF funding. Each institute will receive approximately $28 million to $37 million over five years, providing long-term resources for research into some of the most difficult scientific and engineering challenges facing quantum technologies.

The program spans a broad range of priorities. Researchers will investigate fault-tolerant quantum systems, practical quantum error correction, modular and hybrid quantum networks, manufacturable superconducting devices, quantum algorithms, neutral-atom and trapped-ion platforms, precision sensing, and robust quantum simulation. Together, these efforts address both the fundamental science of quantum information and the engineering needed to transform laboratory advances into scalable technologies.

Collaboration is central to the initiative. The eight institutes will connect researchers across 36 higher-education institutions in 19 states with U.S. Department of Energy national laboratories, the Department of Defense, the National Institute of Standards and Technology, and more than 30 companies. These partnerships are intended to accelerate the transfer of scientific discoveries into techniques and products that can eventually be manufactured and deployed at industrial scale.

The investment also places strong emphasis on education and workforce development. Over the next five years, the institutes are expected to train hundreds of graduate students, undergraduates, and early-career researchers through internships, summer schools, mentorship programs, community-college partnerships, and activities for schools and teachers.

By funding multiple technologies and research directions rather than concentrating on a single hardware platform, the NSF is supporting a diversified path toward practical quantum systems. The initiative strengthens the U.S. quantum research ecosystem while building the scientific talent, institutional partnerships, and engineering foundations needed for future advances in computing, communications, sensing, medicine, and materials science.

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