FermiLab leader of a computing revolution

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The U.S. Department of Energy’s Fermilab has been selected to lead one of five national centers to bring about transformational advances in quantum information science as a part of the U.S. National Quantum Initiative, announced the White House Office of Science and Technology Policy, the National Science Foundation and the U.S. Department of Energy today.

The initiative provides the new Superconducting Quantum Materials and Systems Center funding with the goal of building and deploying a beyond-state-of-the-art quantum computer based on superconducting technologies. The center also will develop new quantum sensors, which could lead to the discovery of the nature of dark matter and other elusive subatomic particles. Total planned DOE funding for the center is $115 million over five years, with $15 million in fiscal year 2020 dollars and outyear funding contingent on congressional appropriations. SQMS will also receive an additional $8 million in matching contributions from center partners.

The SQMS Center is part of a $625 million federal program to facilitate and foster quantum innovation in the United States. The 2018 National Quantum Initiative Act called for a long-term, large-scale commitment of U.S. scientific and technological resources to quantum science.

The revolutionary leaps in quantum computing and sensing that SQMS aims for will be enabled by a unique multidisciplinary collaboration that includes 20 partners – national laboratories, academic institutions and industry. The collaboration brings together world-leading expertise in all key aspects: from identifying qubits’ quality limitations at the nanometer scale to fabrication and scale-up capabilities into multiqubit quantum computers to the exploration of new applications enabled by quantum computers and sensors.

“The breadth of the SQMS physics, materials science, device fabrication and characterization technology combined with the expertise in large-scale integration capabilities by the SQMS Center is unprecedented for superconducting quantum science and technology,” said SQMS Deputy Director James Sauls of Northwestern University. “As part of the network of National QIS Research centers, SQMS will contribute to U.S. leadership in quantum science for the years to come.”

At the heart of SQMS research will be solving one of the most pressing problems in quantum information science: the length of time that a qubit, the basic element of a quantum computer, can maintain information, also called quantum coherence. Understanding and mitigating sources of decoherence that limit performance of quantum devices is critical to engineering in next-generation quantum computers and sensors.

“Unless we address and overcome the issue of quantum system decoherence, we will not be able to build quantum computers that solve new complex and important problems. The same applies to quantum sensors with the range of sensitivity needed to address long-standing questions in many fields of science,” said SQMS Center Director Anna Grassellino of Fermilab. “Overcoming this crucial limitation would allow us to have a great impact in the life sciences, biology, medicine, and national security, and enable measurements of incomparable precision and sensitivity in basic science."

The SQMS Center's ambitious goals in computing and sensing are driven by Fermilab's achievement of world-leading coherence times in components called superconducting cavities, which were developed for particle accelerators used in Fermilab's particle physics experiments. Researchers have expanded the use of Fermilab cavities into the quantum regime.

"We have the most coherent – by a factor of more than 200 – 3-D superconducting cavities in the world, which will be turned into quantum processors with unprecedented performance by combining them with Rigetti's state-of-the-art planar structures," said Fermilab scientist Alexander Romanenko, SQMS technology thrust leader and Fermilab SRF program manager. "This long coherence would not only enable qubits to be long-lived, but it would also allow them to be all connected to each other, opening qualitatively new opportunities for applications."

From https://news.fnal.gov/2020/08/fermilab-to-lead-115-million-national-quantum-initiative-center-to-build-revolutionary-quantum-computer-with-rigetti-computing-northwestern-university-ames-laboratory-nasa-infn-and-additional-par/

COMPREHENSION QUESTIONS

1. What's Fermilab?
2. When was Fermilab chosen to be at the head of a revolutionary project in the field of technology?
3. What's a quantum?
4. Why are quantum sensors so important to work out?
5. Are there any laws in the United States of America which encourage and support the scientific development?
6. In the webpage opinion, is working alone the better solution to succeed?
7. Which competences do scholars need to draw this historical progress?
8. What's a qubit?
9. Which is the subject of the verb «will be»? And the subject of «aims for»?
10. Why can this period be considered a very lucky moment for the quantum science and technology?
11. Which is the most urgent problem in quantum information science, nowadays?
12. So, what's the research focus?
13. Why, in Grassellino's opinion, is it very important to get over «this crucial limitation»?
14. Where does Anna Grassellino come from?
15. Why is Fermilab judged capable to manage the project?
16. Who/What is Rigetti?
17. What do Fermilab scientists expect from these studies?
18. Focus on Grammar and Microlanguage