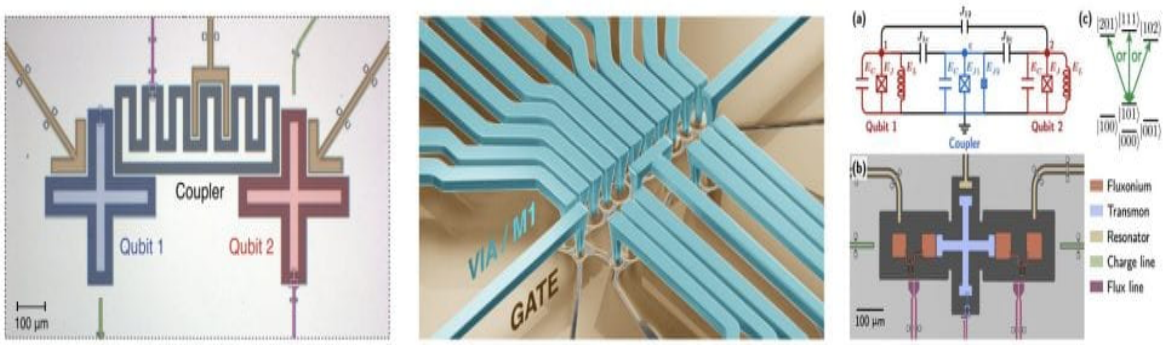


Qubits for Computing Foundry (QCF) announcement

June 14, 2023

The Laboratory for Physical Sciences (LPS), in collaboration with the Army Research Office (ARO), is proud to announce that Lincoln Laboratory, Intel Corporation, and HRL Laboratories are partnering with the LPS Qubit Collaboratory (LQC) in the *Qubits for Computing Foundry* program. These efforts are putting state-of-the-art superconducting and spin qubits into the hands of leading U.S. research groups to enable groundbreaking scientific research and discovery.

Experimental research in the field of quantum computing requires access to high quality qubit devices. However, the multi-million-dollar equipment and years of process development required to reproducibly fabricate such devices are formidable barriers to entry. For most research institutions, producing qubit devices with state-of-performance and yield is, for all practical purposes, out of reach. Overcoming these barriers is key to accelerating scientific progress in this field.

To that end, the LQC is working with three qubit foundries to provide scientists with best-in-class qubits to advance their research. The streamlined process for getting qubits into the hands of research teams across the country enables them to focus resources on advancing the science without needing to invest in building their own fabrication facilities.

“The Qubit Foundry program supports the objectives of the LPS Qubit Collaboratory and the U.S. National Quantum Initiative to move the science of qubits forward,” said T.R. Govindan, Program Manager at the Army Research Office. “I’m pleased these world-class institutions are helping the whole field by working with us.”

Starting with seedling efforts with initially a small number of research user groups, QCF’s goal with each foundry is to optimize the user-foundry interaction model to include design rules, pre-screening, and measurement feedback loops. With sufficient success, the next phase will bring on new users and capabilities, such as new materials or increased device design flexibility.

The first of the three foundries to go live offered superconducting qubit chips fabricated at Lincoln Laboratory (LL). LL qubits have demonstrated state-of-the-art performance: world-leading 2-qubit gate fidelities of near 99.9% [1, 2]. Nine research groups had their own qubit designs fabricated by LL and the resulting research has been published in four scientific papers and thirteen presentations. Building on this success, the LL foundry is now embarking on a 4-year execution plan for its foundry and will expand to supporting more than 20+ research groups over that timeframe.

The next two foundry partners, Intel Corporation and HRL Laboratories, fabricate SiGe/Si quantum dot spin qubits. Intel has announced their partnerships with LPS and three other leading research groups. Under the scope of these partnerships, Intel will provide devices with 12 quantum-dots, fabricated on 300 mm wafers to advance the science of quantum

dot qubits. Intel's 12-qubit device has a 95% yield rate across the wafer and leverages Intel's most advanced transistor fabrication techniques.

The HRL seedling effort will provide world-leading 6-quantum dot devices to LPS and several other research groups. HRL's in-house quantum dot fabrication process, called SLEDGE, promises reduced electrostatic disorder and has reached single qubit gate fidelities near 99.9% [3].

"The Qubits for Computing Foundry program epitomizes the LPS Qubit Collaboratory and its mission to bring the best of academia, industry, national labs, and the government together to train the next generation of scientists and tackle the hardest problems facing quantum information science," said Charles Tahan, Director of the LPS Qubit Collaboratory. "I can't wait to see the creativity these resources will unleash in the community."

For further information on QCF please e-mail: Michael Metcalfe; metcalfe_michael@lps.umd.edu

Found out more:

1. Superconducting qubit foundry accelerates progress in quantum research | MIT Lincoln Laboratory
2. Intel's New Chip to Advance Silicon Spin Qubit Research for Quantum Computing :: Intel Corporation (INTC)
3. HRL Laboratories | News | HRL Laboratories to Share Silicon Qubit Technology

References:

1. Ding et. al. "High-Fidelity, Frequency-Tunable Two-Qubit Fluxonium Gates with a Transmon Coupler", arXIV: 2304.06087, April 2023
2. Sung et. al. "Realization of high-fidelity CZ and ZZ-free iSWAP gates with a tunable coupler", PRX 11, 021058, June 2021
3. Ha et. al. "A flexible platform for Si/SiGe Exchange-Only Qubits with Low Disorder", Nano Lett., 22, 3, p1443, 2022

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