Research from QphoX, Rigetti, and Qblox Demonstrating Optical Readout Technique for Superconducting Qubits Published in Nature Physics

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DELFT, The Netherlands and Berkeley, Calif., Feb. 11, 2025 (GLOBE NEWSWIRE) -- QphoX B.V., a Dutch quantum technology startup that is developing leading frequency conversion systems for quantum applications, Rigetti Computing, Inc. (Nasdaq: RGTI), a pioneer in full-stack quantum-classical computing, and Qblox, a leading innovator in quantum control stack development, today announced that their joint research demonstrating the ability to readout superconducting qubits with an optical transducer was published in *Nature Physics*.

Quantum computing has the potential to drive transformative breakthroughs in fields such as advanced material design, artificial intelligence, and drug discovery. Of the quantum computing modalities, superconducting qubits are a leading platform towards realizing a practical quantum computer given their fast gate speeds and ability to leverage existing semiconductor industry manufacturing techniques. However, fault-tolerant quantum computing will likely require 10,000 to a million physical qubits. The sheer amount of wiring, amplifiers and microwave components required to operate such large numbers of qubits far exceeds the capacity of modern-day dilution refrigerators, a core component of a superconducting quantum computing system, in terms of both space and passive heat load.

A potential solution to this problem may be to replace coaxial cables and other cryogenic components with optical fibers, which have a considerably smaller footprint and negligible thermal conductivity. The challenge lies in converting the microwave signals used to control qubits into infrared light that can be transmitted through fiber. This is where microwave-to-optical transduction comes into play, a field dedicated to the coherent conversion of microwave photons to optical photons. QphoX has developed transducers with piezo-optomechanical technology that are capable of performing this conversion, forming an interface between superconducting qubits and fiber-optics.

To demonstrate the potential of this technology, QphoX, Rigetti and Qblox connected a transducer to a superconducting qubit, with the goal of measuring its state using light transmitted through an optical fiber. The results of this collaborative effort have been published in *Nature Physics*. Remarkably, it was discovered that not only is the transducer capable of converting the signal that reads out the qubit, but that the qubit can also be sufficiently protected from decoherence introduced by thermal noise or stray optical photons from the transducer during operation.

"Microwave-to-optics transduction is a rapidly emerging technology with far-reaching implications for quantum computing. Our work demonstrates that transducers are now ready to interface with superconducting qubit technology. This is an exciting and crucial demonstration, with the potential for this technology being far reaching and potentially transformative for the development of quantum computers," says Dr. Thierry van Thiel, lead author of the work and Lead Quantum Engineer at QphoX.

"Developing more efficient ways to design our systems is key as we work towards fault tolerance. This innovative, scalable approach to qubit signal processing is the result of our strong partnerships with QphoX and Qblox and showcases the value of having a modular technology stack. By allowing our partners to integrate their technology with ours, we are able to discover creative ways to solve long-standing engineering challenges," says Dr. Subodh Kulkarni, Rigetti CEO.

"Realizing industrial-scale quantum computers comes with solving several critical bottlenecks. Many of these lie in the scalability of the readout and control of qubits. As Qblox is entirely focused on exactly this theme, we are proud to be part of this pivotal demonstration that shows that QphoX microwave-to-optical transducers are a solid route to scalable quantum computing. We look forward to the next steps with Rigetti and QphoX to scale up this technology," says Dr. Niels Bultink, Qblox CEO.

About QphoX
QphoX is the leading developer of quantum transduction systems that enable quantum computers to network over optical frequencies. Leveraging decades of progress in photonic, MEMS and superconducting device nanofabrication, their single-photon interfaces bridge the gap between microwave, optical and telecom frequencies to provide essential quantum links between computation, state storage and networking. QphoX is based in Delft, the Netherlands. See https://www.qphox.eu/ for more information.

About Rigetti
Rigetti is a pioneer in full-stack quantum computing. The Company has operated quantum computers over the cloud since 2017 and serves global enterprise, government, and research clients through its Rigetti Quantum Cloud Services platform. In 2021, Rigetti began selling on-premises quantum computing systems with qubit counts between 24 and 84 qubits, supporting national laboratories and quantum computing centers. Rigetti's 9-qubit Novera™ QPU was introduced in 2023 supporting a broader R&D community with a high-performance, on-premises QPU designed to plug into a customer's existing cryogenic and control systems. The Company's proprietary quantum-classical infrastructure provides high-performance integration with public and private clouds for practical quantum computing. Rigetti has developed the industry's first multi-chip quantum processor for scalable quantum computing systems. The Company designs and manufactures its chips in-house at Fab-1, the industry's first dedicated and integrated quantum device manufacturing facility. Learn more at https://www.rigetti.com/.

About Qblox
Qblox is a leading provider of scalable and modular qubit control stacks. Qblox operates at the frontier of the quantum revolution in supporting academic and industrial labs worldwide. The Qblox control stack, known as the Cluster, combines key technologies for qubit control and readout and supports a wide variety of qubit technologies. Qblox has grown to 130+ employees and continues to innovate to enable the quantum industry. Learn more at https://www.qblox.com/.

Reference
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https://www.nature.com/articles/s41567-024-02742-3

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Cautionary Language and Forward-Looking Statements
Certain statements in this communication may be considered “forward-looking statements” within the meaning of the federal securities laws, including statements with respect to the Company’s expectations with respect to its future success and performance, including expectations with respect to the ability to use an optical transducer to perform readout on the Company’s superconducting qubits; the potential with respect to quantum computing driving transformative breakthroughs in fields such as advanced material design, artificial intelligence, and drug discovery; the number of qubits necessary to reach fault tolerance; potential to replace coaxial cables and other cryogenic components with optical fibers; the ability to convert microwave signals used to control qubits into infrared light that can be transmitted through fiber; expectations of using optical transducers to protect a qubit from decoherence introduced by thermal noise or stray optical photons; readiness of interfacing optical transducers with semiconducting qubit technology; expectations with respect to scaling to create larger qubit systems without sacrificing gate performance using the Company’s modular chip architecture, including expectations with respect to the Company’s anticipated systems; expectations with respect to the Company’s partners and customers and the quantum computing plans and activities thereof; and expectations with respect to the anticipated stages of quantum technology maturation, including the Company’s ability to develop a quantum computer that is able to solve practical, operationally relevant problems significantly better, faster, or cheaper than a current classical solution and achieve quantum advantage on the anticipated timing or at all; expectations with respect to the quantum computing industry and related industries. These forward-looking statements are based upon estimates and assumptions that, while considered reasonable by the Company and its management, are inherently uncertain. Factors that may cause actual results to differ materially from current expectations include, but are not limited to: the Company’s ability to achieve milestones, technological advancements, including with respect to its technology roadmap, help unlock quantum computing, and develop practical applications; the ability of the Company to obtain government contracts successfully and in a timely manner and the availability of government funding; the potential of quantum computing; the ability of the Company to expand its QPU sales and the Novera QPU Partnership Program; the success of the Company’s partnerships and collaborations; the Company’s ability to accelerate its development of multiple generations of quantum processors; the outcome of any legal proceedings that may be instituted against the Company or others; the ability to maintain relationships with customers and suppliers and attract and retain management and key employees; costs related to operating as a public company; changes in applicable laws or regulations; the possibility that the Company may be adversely affected by other economic, business, or competitive factors; the Company’s estimates of expenses and profitability; the evolution of the markets in which the Company competes; the ability of the Company to implement its strategic initiatives, expansion plans and continue to innovate its existing services; the expected use of proceeds from the Company’s past and future financings or other capital; the sufficiency of the Company’s cash resources; unfavorable conditions in the Company’s industry, the global economy or global supply chain, including financial and credit market fluctuations and uncertainty, rising inflation and interest rates, disruptions in banking systems, increased costs, international trade relations, political turmoil, natural catastrophes, warfare (such as the ongoing military conflict between Russia and Ukraine and related sanctions and the state of war between Israel, Hamas and Hezbollah and related threat of a larger conflict), and terrorist attacks; the Company’s ability to maintain compliance with the continued listing standards of the Nasdaq Capital Market; and other risks and uncertainties set forth in the section entitled “Risk Factors” and “Cautionary Note Regarding Forward-Looking Statements” in the Company’s Annual Report on Form 10-K for the year ended December 31, 2023 and Quarterly Report on Form 10-Q for the quarter ended September 30, 2024, and other documents filed by the Company from time to time with the SEC. These filings identify and address other important risks and uncertainties that could cause actual events and results to differ materially from those contained in the forward-looking statements. Forward-looking statements speak only as of the date they are made. Readers are cautioned not to put undue reliance on forward-looking statements, and the Company assumes no obligation and does not intend to update or revise these forward-looking statements other than as required by applicable law. The Company does not give any assurance that it will achieve its expectations.