Nord Quantique Demonstrates Quantum Error Correction, First Company to Make a Logical Qubit Out of a Physical Qubit

Innovative Method with a Single Physical Qubit Makes for a Highly Scalable Superconducting System, With Usable Clock Speed

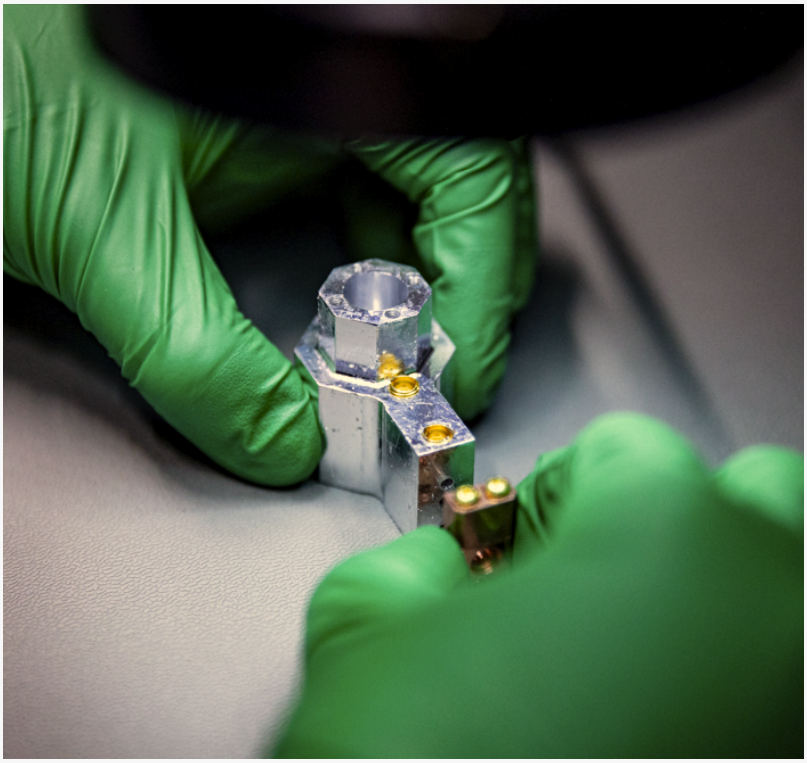
The team at Nord Quantique celebrates a 14% increase in the lifetime of a single qubit without using the 'brute force' redundancy of additional physical qubits

SHERBROOKE, QUEBEC, CANADA, February 8, 2024 /EINPresswire.com/ -- Nord Quantique, a quantum computing startup with an industry leading approach to error correction, today announced promising results from its latest research paper. Using its hardware efficient approach, Nord Quantique is now the first company in the world to demonstrate quantum error correction to improve qubit coherence lifetime at the individual qubit level. The company has achieved an increase of 14% in the lifetime of a single qubit without using the 'brute force' redundancy of additional physical qubits.

Furthermore, simulations run by the company show not only that these results can be reproduced with additional qubits, but that there is likely to be to significant, further improvement in error correction as the number of qubits increases. This indicates that Nord Quantique's quantum computers will function with far fewer resources dedicated to error correction, thereby requiring only hundreds of qubits to deliver fault tolerant quantum computing instead of millions. Thus, making the path to scaling this hardware to levels useful for industrial partners a much shorter one. As a next step, the company plans to unveil results from a multi-qubit system later this year.

"There is a consensus in the industry that useful quantum computing cannot be achieved without error correction. Our team at Nord Quantique is very proud to be the first company to extend the lifetime of a logical qubit without a large overhead of physical qubits dedicated to error correction, as most other systems have. After years of diligent work, this demonstration

marks the first major milestone on our journey to error-corrected, fault-tolerant quantum computing," said Julien Camirand Lemyre, President and CTO at Nord Quantique. "Our model incorporates redundancy into every logical qubit, drastically reducing the number of physical qubits required for error correction once scaled. This positions us well to develop highly efficient and scalable quantum computers, without the need for vast amounts of physical qubits devoted to error correction, and potentially reaching fault-tolerance in a shorter time."



An aluminum cavity developed by Nord Quantique to improve the lifetime of an individual qubit without a large overhead of physical qubits

Nord Quantique's company logo

By applying GKP bosonic codes for error correction at the individual qubit level, Nord Quantique has demonstrated the ability to correct both bit-flips and phase-flips, the most common types of errors in quantum computing. This makes error correction much easier to manage, and may require between 1,000 and 10,000 times fewer physical qubits than other computing models to effectively manage errors in the superconducting system and deliver useful results. Furthermore, once at scale, Nord Quantique's system will operate with clock speeds at megahertz frequency, between 100 and 1,000 times faster than some competing systems.

The company believes this three-pronged combination of efficient error correction, fast computational speeds and a clear road to scaling makes its systems ideally suited for problems such as the simulations required in the materials science and pharmaceutical industries, as well as several other sectors which can benefit from advanced calculations using deep circuits and complex algorithms. Moreover, through eliminating the need for a vast overhead of physical qubits dedicated to error correction, the company believes it may deliver useful quantum computing sooner by devoting more resources to increasing the number of logical qubits.

These results are produced avoiding the ‘brute force’ approach to error correction. Rather, by injecting microwave photons into a high-quality superconducting cavity and controlling their state using precise microwave pulses, Nord Quantique has managed to exploit the built-in redundancy this system provides to enable error correction within the qubit itself. This means even at scale, that each of these individual physical qubits could ultimately be operated as logical qubits.

About Nord Quantique
Founded in 2020 in Sherbrooke, Quebec – Canada’s leading quantum hub, Nord Quantique is committed to overcoming the challenge of quantum error correction, today’s principal barrier to fault-tolerant quantum computing. By addressing the most common types of errors on individual qubits, Nord Quantique is poised to deliver industry-leading error correction with high-speed processing. Few errors combined with fast calculation speeds means the company will be able to deliver useful quantum computing sooner, without having to scale to millions of qubits. This more readily enables reliable operation of useful quantum computers with a wide array of industry applications. For additional insight into our pioneering work, please visit nordquantique.ca.

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