Researchers demonstrate quantum error mitigation on prototype, extending coherent annealing range by order of magnitude

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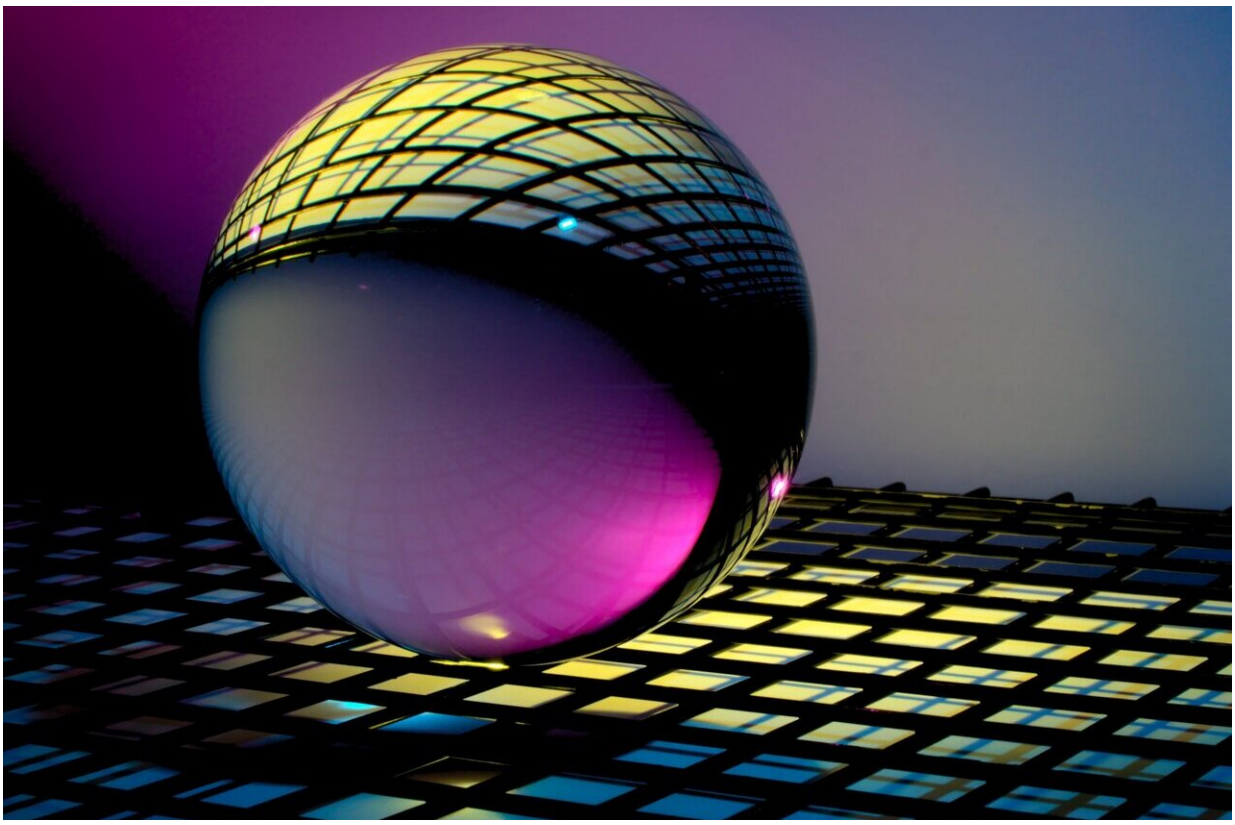

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D-Wave Quantum Inc. has announced research results that demonstrate successful Quantum Error Mitigation (QEM) in its Advantage2

annealing quantum computing experimental prototype.

The techniques reduce errors in quantum simulations, producing results consistent with the quantum system maintaining its quantum state ("coherence") for an order of magnitude longer time than an unmitigated system. These techniques are expected to drive performance advancements in the forthcoming Advantage2 system and future processors.

The work is published on the *arXiv* preprint server.

Quantum computation can be hampered by environmental noise and hardware imperfections, known as errors. While Quantum Error Correction is widely acknowledged by the industry as the ultimate solution for eliminating the impact of these errors, it comes with significant overhead, making it impractical with the current state of technology.

QEM has emerged as a near-term solution for estimating error-free expectation values in the presence of small noise. This research marks D-Wave's first experimental demonstration of Zero-Noise Extrapolation (ZNE), one of the most practical QEM techniques, within its annealing quantum computing systems.

It offers valuable insights into the performance of more coherent systems and assists in determining design specifications for our next-generation processors. Further, these results could prove beneficial for helping customers tackle highly computationally complex problems in scientific-related and machine learning applications.

"Errors represent the most significant obstacle in all forms of quantum computation," said Mohammad Amin, fellow, quantum algorithms and systems, who led the research at D-Wave.

"This work demonstrates the successful mitigation of such errors in quantum annealing, producing measurement results as if the qubits were nearly one order of magnitude more coherent. This enables computation in regimes that were previously inaccessible, such as quantum simulations of exotic magnetic materials, an important milestone on the road to demonstrating quantum supremacy on D-Wave processors."

This work is the latest in the company's advancements of coherent annealing quantum computing. In September 2023, D-Wave announced notable progress in the development of high coherence fluxonium qubits.

More information: Mohammad H. Amin et al, Quantum error mitigation in quantum annealing, *arXiv* (2023). DOI: 10.48550/arxiv.2311.01306

Provided by D-Wave Quantum Inc.