

# ACCELERATING GROUNDBREAKING SCIENTIFIC DISCOVERIES WITH QUANTUM-POWERED RESEARCH

**D-Wave Quantum Inc. offers researchers powerful annealing quantum computing technology capable of fueling important scientific advancements.**

With the world's largest annealing quantum computer comprising 5000+ qubits, a real-time quantum cloud service, development tools, specialized training, and active collaborations, D-Wave can help researchers turn complex research challenges into impactful discoveries and state-of-the-art innovations.

The company delivers access to cutting-edge quantum technologies — both quantum and hybrid-quantum solutions — that meet the needs of the research community and leading national laboratories. These

solutions offer resources for complex optimization problem solving, materials science research, and the integration of quantum, AI, and machine learning (ML).

D-Wave is the only company developing both annealing and gate-model quantum computing systems. Its technology can integrate seamlessly with foundational computing technologies such as cloud computing and high-performance computing, allowing researchers to explore the full potential of hybrid-quantum systems for computational power and efficiency.



**“Together with D-Wave, we are putting quantum computing power into the hands of our researchers who want to harness this transformative technology to solve the world’s toughest challenges.”**

**—Yannis C. Yortsos, Dean of the USC Viterbi School of Engineering**

## COHERENT QUANTUM DYNAMICS AT SCALE

In early 2024, the company released its 1200+ qubit Advantage2™ annealing quantum computing prototype, providing performance improvements over its previous Advantage™ system. The prototype's early performance benchmarks over its predecessor include:

- 20 times faster time-to-solution on an important class of hard optimization problems
- Increased qubit connectivity from 15-way to 20-way to solve larger problems
- 40% increase in energy scale, delivering higher quality solutions
- Doubled coherence for faster time-to-solution



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## COMPARISON OF D-WAVE'S SYSTEMS

System	D-Wave 2000Q™ QPU	Advantage QPU	Latest Advantage2 QPU Prototype (July 2024)
Better Solutions (Satisfiability problems)	-	Better solution quality than D-Wave 2000Q QPU 81% of the time	Better solution quality than Advantage QPU 87% of the time
Time-To-Solution (3D lattice problems; annealing time)	-	10x faster than D-Wave 2000Q QPU	20x faster than Advantage QPU
Topology	Chimera™ topology	Pegasus™ topology	Zephyr™ topology
Qubits	2000+	5000+	1200+
Couplers	6000+	40,000+	11,000+
Connectivity	6-way	15-way	20-way
Largest embedded 3D lattice	8x8x8	15x15x12	6x6x16
Largest embedded clique	64	180	82

The Advantage2 prototype is a significant step toward the highly anticipated full Advantage2 system, which is expected to feature 7000+ qubits on top of the lower-noise fabrication stack and Zephyr topology already in the latest prototype. This system will be D-Wave’s sixth-generation quantum computer and is designed to provide even greater computational abilities for customers.

D-Wave recently introduced the fast-anneal feature, available on all its quantum computers — including the new Advantage2 prototype — giving quantum researchers access to powerful, coherent annealing quantum computing. The feature allows quantum computations in a regime that greatly reduces the impact of external disturbances, such as thermal fluctuations, that can often hinder quantum calculations.

The fast-anneal feature has played a key role in D-Wave’s recent research milestones, including a March 1, 2024, paper entitled “Computational Supremacy in Quantum Simulation.” Now under peer review and available as an arXiv preprint, the research highlights what the company believes is a demonstration of quantum supremacy, achieved on the Advantage2 prototype on problems that cannot be solved by classical computers. Customer demand for the feature is reflected in its usage — solving nearly 2.5 million customer problems in the four months since its launch in April 2024.

Scan the QR code to read this paper.



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“Fast anneal will assist researchers in observing the distinctive physical processes inherent in the quantum world. Heightened coherence and reduced environmental interference will open avenues in quantum sciences.”

—Alejandro Lopez-Bezanilla, Staff Research Scientist at Los Alamos National Laboratory

## CUTTING-EDGE RESEARCH REQUIRES 24/7 ACCESS

Unlike many other quantum vendors, D-Wave offers immediate access to its quantum technologies, meeting researchers' requirements for accelerated experimentation, real-time problem solving, and the ability to rapidly iterate without delays.

National laboratories, federally funded research and development centers, and military research labs can use D-Wave's advanced computational capabilities for materials science exploration, next-generation quantum systems research, and quantum AI experimentation.

As AI and ML development progresses, D-Wave's product development roadmap includes Quantum AI solutions available through the Leap™ quantum cloud service. These solutions leverage annealing quantum computing's unique capability in solving optimization problems to help customers discover better, faster, and more energy efficient AI and ML workloads.



“By providing direct access to quantum computing's central nervous system, D-Wave is single-handedly opening new horizons for our research on quantum computing and AI.”

—Ed Heinbockel, President and CEO of SavantX

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