Aug 19, 2026 – Aug 20 · Daily Brief

IBM cryogenic module interconnect succeeds, bringing the 2029 Star Pulse quantum computer one step closer.

57 items · 13 sources | PDF | This issue's roundup is free

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CURRENTSOTA

Physical qubits	1,180
2Q fidelity	99.99%
Logical qubits	96 LQ

Quantum hardware SOTA table →

01 Other

Three Things Today

1 **IBM Cryogenic Module Interconnect** IBM announced the first completed interconnection and coordinated cooling of modular cryogenic units, paving the way for the 2029 Starling fault-tolerant quantum computer[11]—marking a critical step for the superconducting route toward scalable multi-chip architectures.

2 **EigenQ $3 Billion SPAC Merger** EigenQ and Silicon Valley Acquisition Corp. confidentially submitted a draft S-4 registration statement to the SEC, advancing a SPAC merger with a pro forma valuation of $3 billion[9]—the wave of

quantum companies going public via SPAC continues, accelerating capital access.

3 **Diraq Establishes First U.S. Lab** Silicon spin qubit company Diraq has set up its first U.S. R&D measurement laboratory at the IQMP campus in Chicago[10]—the Australian quantum startup is moving closer to the U.S. manufacturing ecosystem, accelerating engineering efforts.

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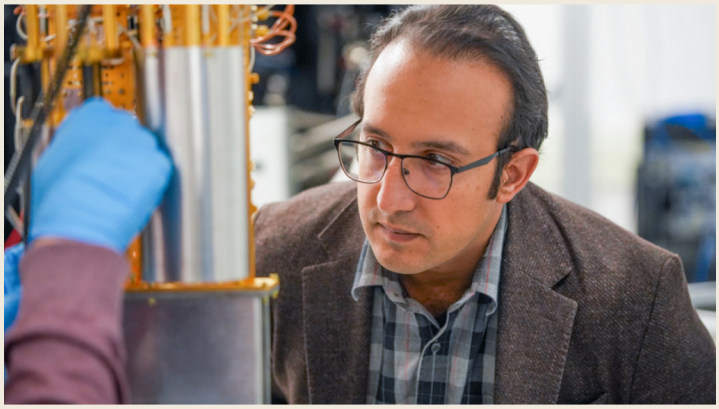
02 Hardware

Hardware Frontier



Superconducting Quantum

IBM announced the first interconnection and coordinated cooling of two modular cryogenic units, completed in Poughkeepsie, New York, targeting delivery of the fault-tolerant quantum computer Starling by 2029[11]. This is IBM's first demonstration of hardware feasibility for multi-chip cryogenic interconnect. Previously, the

number of qubits a single dilution refrigerator could accommodate was limited, and modular interconnect is an essential threshold for scaling superconducting quantum processors. IBM's choice of a multi-module route aims to bypass single-chip yield and wiring bottlenecks. If the 2029 milestone is achieved, IBM will deliver its fault-tolerant quantum computer on schedule; however, IBM has not yet published qubit fidelity and crosstalk data after interconnection, leaving a considerable gap before practical utility.

Superconducting Materials and Processes

A Cornell University team led by Valla Fatemi lowered the deposition temperature of tantalum-based superconducting qubits to 200°C, using krypton gas instead of standard argon in magnetron sputtering, with results published in Nature Materials[8]. Sources indicate this low-temperature process resolves a major manufacturing bottleneck for superconducting quantum processing units (QPUs); this creates an opportunity for tantalum-based superconducting qubits to be used in larger-scale integrated manufacturing. If the process is validated in foundries, the manufacturability of superconducting quantum processors will improve significantly, but TLS (two-level system) fluctuations in tantalum-based qubits remain a ceiling on fidelity.

Photonics

Integrated photonic circuits have achieved programmable spectral filtering with wavelength suppression contrast up to 40 dB[17]. This is progress in feed-forward photonic meshes for on-chip high-contrast filtering, which is critical for mode cleaning and frequency multiplexing in photonic quantum computing. Photonic-route companies such as PsiQuantum and Xanadu can leverage this to improve photonic state preparation purity, but practical utility still requires end-to-end loss budget and conditional fidelity verification across the full chain.

Topology and Materials

Researchers in South Korea identified the origin of "beat" signals in topological insulator nanowires[42]. This work clarifies the physical mechanism of oscillation signals commonly observed in transport measurements of topological insulator nanowires, providing a criterion for distinguishing topological surface states from trivial bulk states. This aids material characterization for topological qubits, but topological qubits themselves remain in an early stage, and routes pursued by companies such as Microsoft have yet to demonstrate scalable quantum operations.

Quantum Thermal Management

New research demonstrates that quantum transistors can control heat flow in circuits, comparing harmonic oscillators, transmons, and Kerr environments[13]. This compares the influence of different nonlinear environments on heat flow regulation at the quantum circuit level, providing a reference for the design of quantum thermal management devices. The short-term impact is confined to academia, but in the long term it may offer new ideas for heat dissipation in quantum processors.

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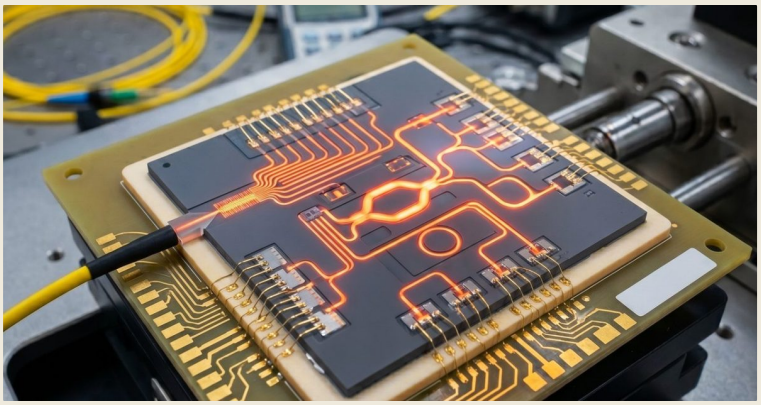
03 Algorithms

Algorithms and Software



Quantum Error Correction and Logical Gates

Researchers proposed concatenated symplectic double codes, enabling simple logical quantum computation[26]. This code family possesses a

rich set of logical gates, a large number of which require only physical single-qubit gates and qubit relabeling, reducing the complexity of fault-tolerant logical operations. Compared with the transversal gate limitations of surface codes, symplectic double codes provide more efficient implementations of logical Clifford gates. If experimentally validated, this could reduce the physical overhead of logical qubits, but the work currently remains at the level of code construction and protocol design.

Quantum Control Optimization

The PEPRino algorithm is used for high-fidelity multi-qubit control protocols, converging faster than the Chopped Random Basis method in two-qubit systems and requiring no hyperparameters[16]. This algorithm achieves hyperparameter-free quantum control optimization based on response theory, avoiding manual parameter tuning. It has direct value for quantum gate engineering and pulse design, and can accelerate high-fidelity gate calibration, but sources do not disclose its validation on real hardware.

Quantum Circuit Compilation

Researchers used a compiler automatically generated by a large language model to produce shuttling code for complex ion-trap architectures,

reducing shuttling time steps by up to 76%. Complete compiler code that previously required months of manual design can now be completed in days, and critical operation times in densely connected architectures are reduced by a factor of 10[15]. This applies generative programming to ion-trap shuttling schedule optimization, alleviating the bottleneck where manual design is impractical for multi-segment ion-trap architectures. QCCD-architecture companies such as IonQ and Quantinuum stand to benefit, reducing compiler development overhead and improving circuit execution efficiency.

Quantum Simulation Algorithms

New work demonstrates that strong unitary designs can be constructed in logarithmic depth using only the original system qubits[18]. Previously, achieving strong unitary designs required higher circuit complexity or additional qubits; logarithmic depth is theoretically optimal, providing an efficient tool for quantum scrambling, randomized benchmarking, and algorithm design. This result is a theoretical breakthrough, but experimental implementation still requires support from high-fidelity gates.

Open Quantum System Simulation

A finite-dimensional reduction method for Wigner dynamics achieves exact quantum dynamics

simulation while reducing the required dimensionality[25]. This provides a scalable approach for numerical simulation of open quantum systems, avoiding the exponential overhead of full density matrices. It directly benefits research in quantum dissipation and quantum thermodynamics, but the scope of applicability of the method remains to be further delineated.

Quantum Phase Estimation

Quantum phase estimation using three control qubits achieves the optimal confidence interval[28]. This scheme uses only three control qubits, with the optimal confidence interval given by discrete prolate spheroidal sequences, and provides a more efficient state preparation method, reducing the demand for auxiliary qubits. It has practical significance for ground-state energy estimation in quantum chemistry simulations and can reduce resource overhead.

Industry and Ecosystem

Listings and Financing

EigenQ and Silicon Valley Acquisition Corp. confidentially submitted a draft S-4 registration statement to the SEC, advancing a SPAC merger with a pro forma valuation of $3 billion[9]. The merger is still in the regulatory filing stage. If ultimately completed, EigenQ will become another quantum computing company to enter public markets via SPAC after IonQ and Rigetti, and the $3 billion pro forma valuation is at the high end among pure-play quantum computing companies. At that point EigenQ will gain access to public market financing, but it will need to confront the share price volatility and liquidity risks commonly seen after SPAC listings.

Government Investment

Innovate UK will invest up to £14.3 million in quantum sensing and positioning, navigation, and timing (PNT) projects, covering areas such as healthcare and transportation[21]. This is another

implementation of the UK National Quantum Strategy, with emphasis on supporting quantum sensing rather than computing, reflecting the expansion of practical quantum technology applications from computing to sensing. This is a direct positive for UK quantum startups, but sources do not disclose the specific funding disbursement timeline.

Company Expansion

Diraq has opened its first U.S. R&D measurement laboratory at the IQMP campus in Chicago[10]. Headquartered in Sydney and focused on silicon spin qubits, Diraq's move brings it closer to the U.S. quantum manufacturing ecosystem and potential customers. Chicago is emerging as a quantum hub in the U.S. Midwest, and Diraq's presence will help it access talent and foundry resources, but the silicon spin route still lags behind superconducting and ion-trap approaches in qubit count.

Quantum Sensing Applications

Ideon Technologies has joined the laser-driven muon imaging consortium[43]. Muon imaging can be used for geological exploration and infrastructure inspection, and laser-driven muon sources are an emerging technology that can reduce dependence on large accelerators. The consortium's current goal is to attempt the world's

first fully laser-driven high-resolution muon imaging experiment; sources do not provide a commercialization timeline.

Image Sensing

Singular Photonics has secured $2.15 million in financing to develop SPAD-based quantum-enhanced image sensors[24]. SPAD (single-photon avalanche diode) arrays have broad applications in low-light imaging, lidar, and other fields, and quantum enhancement can improve sensitivity and noise performance. The financing scale is small, indicating an early-stage technology validation phase.

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05 Other

Academic Frontier

Quantum Entanglement Measures

New work proposes quantifying mixed-state entanglement using partial transpose and

realignment moments[27]. This method provides an experimentally measurable lower bound for entanglement measures in many-body mixed systems, avoiding full state tomography. It has practical value for entanglement verification in quantum many-body physics and quantum information processing, but experimental implementation requires efficient measurement schemes.

Mechanical Squeezing

Mechanical squeezing achieved through feedback control, published in npj Quantum Information[7]. This is a new feedback control scheme for squeezed states of mechanical oscillators. The work provides a new tool for quantum precision measurement and quantum transducers, but the degree of squeezing and stability still need improvement.

Molecular Quantum State Loops

Optimized state networks in bialkali molecules identified closed loops of four states with minimized leakage[12]. This provides a more robust path for state preparation and manipulation of molecular qubits, reducing decoherence leakage. Molecular quantum computing remains in an early stage, and this work's contribution focuses on minimizing population leakage in state loops.

Germanium Hole Spins

Leveraging the strong spin-orbit interaction of "light holes" in germanium to enhance electrical control of spin qubits[14]. This provides a faster electrically controlled gate operation pathway for germanium-based spin qubits. However, sources do not provide comparisons with silicon-based spin qubits on metrics such as coherence time, and the actual benefits still require further validation through materials engineering.

Aperiodic Thermalization

A Colorado team linked aperiodicity with rapid thermalization, providing computable predictions on finite timescales[20]. This theoretical framework goes beyond traditional infinite-time thermalization descriptions, imposing stronger constraints on the thermalization behavior of complex quantum systems. It has guiding significance for quantum simulators and quantum many-body physics research, but experimental verification remains to be conducted.

Millicharged Particle Detection

Research from Fermilab, Stanford University, and the University of Delaware shows that one of the oldest precision experiments can be used to search for millicharged particles[1]. The researchers demonstrate that this classic precision measurement apparatus can also be

used to search for millicharged particles, providing a new detection pathway for dark matter candidate particles. If experimental sensitivity reaches expectations, it may impose constraints on new physics beyond the Standard Model of particle physics.

Quantum Phase Transition Mechanisms

MIT physicists discovered that two electronic phases in the same quantum material emerge through different mechanisms—one evolving smoothly, the other appearing as expanding pockets similar to ice crystal growth[29]. This explains how exotic properties such as superconductivity and magnetism coexist, providing a new perspective for quantum material design. This discovery is fundamental research with long-term implications for material selection in quantum devices.

Quantum Heat Engines

Researchers at the University of Basel developed a theoretical framework that better reconciles quantum physics and thermodynamics in microscopic "light engines"[30]. This work clarifies the definition of usable energy in waste heat at the quantum scale, providing a theoretical foundation for optimizing quantum heat engine efficiency. There is no direct short-term application, but it

provides guidance for the design of quantum thermodynamics experiments.

Photon Timing

Superconducting nanowire single-photon detectors (SNSPDs) have achieved picosecond-level timing jitter[23]. This is the latest advance in SNSPD timing performance; picosecond-level jitter can improve the precision of photon coincidence measurements in quantum information processing. It is critical for time synchronization in photonic quantum computing and quantum communication, but array uniformity and yield remain bottlenecks.

Qubit Shielding

QTREX converts 3D-printed insulating components into graphene-like carbon for use as stray photon absorbers, improving qubit lifetimes[19]. This is an innovative application of 3D-printed materials in quantum device shielding, reducing decoherence caused by stray light. The method is low-cost and customizable, but shielding effectiveness needs to be validated across different qubit platforms.

Today's Impact

1. **Increased confidence in the superconducting quantum computing route**: IBM's successful cryogenic module interconnect[11] demonstrates the feasibility of multi-chip superconducting architectures. Investor confidence in IBM's 2029 Starling program may rise, but subsequent fidelity data will need to be monitored.

2. **Quantum company listing channel reopens**: EigenQ's SPAC merger progress[9] provides a listing template for other quantum startups, but whether the $3 billion valuation will be accepted by secondary markets remains uncertain. SEC review progress over the next six months is key.

3. **Silicon spin route accelerates U.S. footprint**: Diraq's Chicago laboratory[10] brings silicon spin qubits into the U.S. Midwest manufacturing ecosystem and may attract more foundry partnerships, but the route still

lags in qubit count, and its subsequent qubit scaling capability needs to be observed.

4 **Quantum sensing receives substantial funding**: Innovate UK's £14.3 million investment[21] will directly advance the development of quantum PNT and medical sensing prototypes in the UK. Related startups may deliver testable products within the next year.

5 **Quantum algorithm toolchain optimization**: The ion-trap shuttling compiler's manual development cycle has been reduced from months to days, with shuttling time steps reduced by up to 76%[15]. IonQ and Quantinuum users may experience improved circuit execution efficiency within the next six months.

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07 Other

Editor's Note

Today's news reveals a key inflection point in the quantum computing industry: the competitive focus is shifting from single-qubit performance to systems engineering capability. IBM's cryogenic module interconnect, Diraq's U.S. laboratory, and the dramatic shortening of ion-trap compiler development cycles all point to the same fact—quantum computers are transforming from laboratory devices into complex systems requiring manufacturing, integration, and software optimization. The superconducting route has long been constrained by the capacity ceiling of a single dilution refrigerator, but if IBM's modular approach succeeds, it will redefine what "scalable" means: not cramming more qubits onto a single chip, but making multiple chips work together as one system.

On the capital front, EigenQ's SPAC merger reminds us that the listing window for quantum companies has not closed, but the market's scrutiny of valuations will become stricter. A $3 billion valuation corresponds to a company that is not yet profitable and whose technology route has not yet converged—this requires extraordinary patience from investors. Meanwhile, government funding continues to flow toward quantum sensing rather than quantum computing, indicating that policymakers place greater weight on near-term deployable applications. This pattern of "hot computing, practical sensing" is likely to persist

for at least two years, until some quantum computing company demonstrates a clear fault-tolerance advantage.

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[3] The World's Leading Quantum Chemistry Clusters & Quantum Life Science Clusters

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[5] IonQ | A Platform Solution to the Deep Trotter Dilemma: Improving Quantum Chemistry Simulations

[6] Securing wireless communication in next-generation devices

[7] Mechanical squeezing via feedback control

[8] Cornell Researchers Lower Tantalum Qubit Deposition Temperature to 200°C Using Krypton Gas Sputtering

[9] EigenQ and Silicon Valley Acquisition Corp. Advance $3B SPAC Merger via Form S-4 Submission

[10] Allot Leads Founding Industry and Academic Consortium to Launch Israeli Post-Quantum Communications Initiative

[11] Diraq Establishes First US Quantum Laboratory at Chicago's IQMP On-Ramp Hub

[12] IBM Links Modular Cryogenic Cells to Scale Multi-Chip Architectures for 2029 Starling Quantum Computer

[13] Researchers limit leakage from molecule quantum state loops

[14] Quantum transistors manage heat flow in circuits, study finds

[15] Germanium's "light holes" boost spin qubit potential

[16] Researchers Generate LLM-Compiled Shuttling Code for Complex Trapped-Ion Architectures

[17] Researchers Propose PEPRino Algorithm for High-Fidelity Multi-Qubit Control Protocols

[18] Photonic mesh rejects wavelengths with up to 40dB contrast

[19] Researchers Build Strong Quantum Designs in Logarithmic Depth

[20] QTREX turns 3D-printed parts into graphene for qubit shielding

[21] Colorado Team Links Aperiodicity to Rapid Thermalization

[22] Senators push bill QED-C says will shield power grid from quantum hacking

[23] Innovate UK to invest up to £14.3M in quantum sensing & PNT projects

[24] $20M NSF grant funds AI-powered materials science at SUNY Poly

[25] Better photon timing could speed up quantum information processing

[26] Singular Photonics gains $2.15M for quantum-enhanced image sensors

[27] Exact quantum dynamics now possible with fewer dimensions

[28] Simple logical quantum computation with concatenated symplectic double codes

[29] Quantifying mixed-state entanglement via partial transpose and realignment moments

[30] Quantum phase estimation with optimal confidence interval using three control qubits

[31] MIT physicists discover electrons rebuilding like ice inside a quantum material

[32] Tiny quantum engines reveal useful energy hiding in "waste heat"

[33] NASA calls off rescue mission for its falling Swift space telescope

[34] Moderna and Merck announce ‘landmark’ trial showing mRNA therapy significantly cuts odds of recurrent skin cancer

[35] Some microbes could survive on the moon—that’s a big problem for NASA

[36] The Milky Way’s Fastest Star Could Expose Our Black Hole’s Spin

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[43] How generative AI is reshaping creativity, and what it means for artists

[44] Diraq Opens First U.S. Quantum Laboratory in Chicago

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[46] EigenQ and Silicon Valley Acquisition Corp Submit Draft S-4 for Proposed Business Combination

[47] IBM Connects Two Modular Cryogenic Systems for Quantum Computing

[48] Ideon Technologies Joins Consortium for Laser-Driven Muon Imaging

[49] Allot Leads New Consortium Focused on Post-Quantum Communications

[50] New Tantalum Process Could Ease Manufacturing of Superconducting Quantum Chips

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[52] The Conversation: The Global Race to Make a Practical Quantum Computer Just Took a Big Leap Forward

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