



AI and Quantum Research Center (AIQRC), Asia University, Taiwan

Activities

Asia University and AIQRC, supported by the Ministry of Education's Taiwan Global Pathfinders Grant Program, provide Taiwan students with world-class experiential learning opportunities through programs in IBM quantum technologies, UCLA academic exchange, quantum finance, humanoid robotics, and astronaut mission training.



(A) IBM dream program



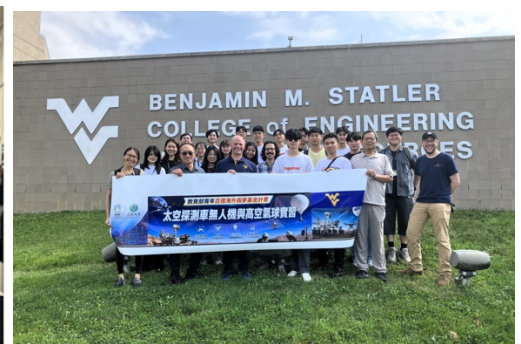
(B) UCLA elite program



(C) Quantum finance program



(D) Humanoid robot program



(E) Astronaut mission training program

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Transitioning from Noisy Medium-Scale Quantum Computing (NISQ) to Fault-Tolerant Quantum Computing (FTQC) and the practical application of Quantum Advantage.

This briefing focuses on:

1. **Quantum AI and Generative Model Integration** : Quantum and Oracle Collaborate to Announce Breakthrough in Generative Quantum AI, Accelerating the Implementation of Materials Design and Big Data Analytics.
2. **Breakthroughs in hardware processes and national research institutions** : Princeton University received significant federal funding to establish the Quantum Leap Challenge Institute, aiming to overcome bottlenecks in chip manufacturing and scalability.
3. **Evolution of Quantum-Centric Supercomputing Architecture** : IBM advances its 2026 roadmap, deeply integrating quantum processors (such as Heron and Nighthawk) with the world's top supercomputers (such as RIKEN Fugaku).
4. **Instantaneous quantum error correction (QEC) and fault-tolerant technology (FTQC) accelerate** : Riverlane and Qblox announce microsecond-level decoder and control system that significantly reduces the physical overhead of logical qubits.
5. **Competition among diverse hardware technologies** : Optical quantum computing and neutral atom architectures have achieved key results in chip integration, coherence time, and reconfigurability.

I. Featured Reports and In-Depth Technical Analysis

1. Quantinuum and Oracle collaborate to launch a commercial architecture for generative quantum AI.

- **Event Overview** : Quantum (August 2026) and Oracle announced a multi-year collaboration to jointly launch a cloud-based Generative Quantum AI technology solution.
- **Key Technology Analysis** :
 - It combines the high-fidelity quantum bit and long coherence time characteristics of ion traps (Trapped-ion) with Oracle Cloud's classic high-performance computing infrastructure.
 - By deeply embedding quantum circuits into the latent space sampling and feature characterization of generative neural networks, the efficiency of molecular structure prediction and complex combinatorial optimization search is greatly improved.
- **Industry impact and trends** : This symbolizes quantum computing moving beyond underlying physical simulation and transforming into an AI-accelerated coprocessor (QPU-AI Co-processor) to enter the enterprise-level cloud ecosystem.
- **News Source** : [Quantinuum Official Press Release \(2026/08/11\)](#)

2. Princeton University leads the establishment of a national quantum research institute, focusing on hardware manufacturing and scalability.

- **Event Overview** : In late August 2026, Princeton University received funding from the National Science Foundation to lead the establishment of the Quantum Leap Challenge Institute.

- **Key Technology Analysis :**
 - The focus is on quantum hardware lithography, material interface loss suppression, and high-yield packaging technology for superconducting/semiconductor qubits.
 - By integrating nanomaterials scientists and quantum information engineers across institutions, modular interconnects that can accommodate thousands to tens of thousands of physical bits are created.
- **Industry impact and trends :** Solving the core engineering challenges of quantum computing from laboratory prototypes to wafer-level fabrication, and promoting the formation of a standardized quantum hardware supply chain.
- **News source :** [Princeton University News \(2026/08/26\)](#)

3. IBM Quantum Center Supercomputing Blueprint: Towards Practical Quantum Advantage by 2026

- **Event Overview :** IBM continues to advance its 2026 technology roadmap, releasing an architecture update for "Quantum-Centric Supercomputing" and deepening its collaboration with RIKEN's Fugaku supercomputer in Japan.
- **Key Technology Analysis :**
 - By leveraging IBM Quantum Nighthawk and Heron processors, along with Dynamic Circuits and Error Mitigation technology, near-practical computing power is unleashed even before full fault tolerance is achieved.
 - Develop the Qiskit Runtime 2.0 distributed scheduler to seamlessly assign quantum circuit operations to 150,000 classical computing nodes and multiple QPUs for collaborative computation.
- **Industry impact and trends :** Establishing "quantum + high-performance classical computing (HPC)" as the most pragmatic computing power upgrade path in the next 5 years.
- **News Source :** [IBM Quantum Roadmap 2026](#) | [IBM HPC Blueprint](#)

4. Breakthroughs in Fault-Tolerant Quantum Computing (FTQC) and Instantaneous Quantum Error Correction (QEC) Technologies

- **Event Overview :** Riverlane and Qblox, companies focused on control systems and error correction architectures, advanced microsecond-level real-time quantum error correction (Real-time QEC) technology in 2026.
- **Key Technology Analysis :**
 - Breaking through the latency bottleneck of classical decoders: Developing dedicated ASIC/FPGA chips to complete error syndrome detection and correction operator feedback within the coherence time of superconducting qubits.
 - Surface codes and low-density parity checking codes (qLDPC) reduce the physical encoding overhead in superconducting and neutral atom systems, significantly reducing the number of physical qubits required to construct logical qubits.
- **Industry impact and trends :** Paving the way for the realization of hundreds of fault-tolerant logical qubits by 2027-2029.
- **News Source :** [Riverlane QEC Technology Roadmap](#) | [Qblox Newsroom](#)

5. Advances in Multiple Hardware Technology Paths: Quantum Photonics and Neutral Atom Chips

- **Photonic Quantum Computing** : The Vienna University of Technology (TU Wien) and an international collaboration published a chip-scale single-photon source and low-loss optical waveguide switch in Nature Photonics; Stanford University also published research on reducing the dependence on cryogenic cooling using twisted light.
- **Neutral Atoms** : QuEra and Pasqal continue to advance optical tweezer rearrangement and two-qubit gate fidelity for arrays of hundreds to thousands of atoms, demonstrating great potential in graph theory algorithms and combinatorial optimization problems.
- **News Source** : [ScienceDaily Stanford Research](#) | [BQP Key Quantum Breakthroughs](#)

II. Industry Observations and Future Outlook

1. **NISQ's transitional strategy towards FTQC** : Major companies are adopting a "quantum error reduction + quantum classical hybrid architecture" to seek commercial value in niche areas such as chemical material simulation, financial derivatives pricing, and cryptographic evolution before pure fault-tolerant hardware matures.
2. **Post-quantum cryptography (PQC) deployment accelerates** : As quantum hardware computing power and bit fidelity advance exponentially, enterprises and governments are accelerating the migration to the NIST PQC standard, and quantum security has become a core cybersecurity agenda.
3. **Quantum engineering talent and software ecosystem construction** : Quantum software development kits (Qiskit, PennyLane, Cirq) are developing towards a hardware-agnostic abstraction layer that enables automatic compilation of high-order algorithms.

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