

Quantum Computing

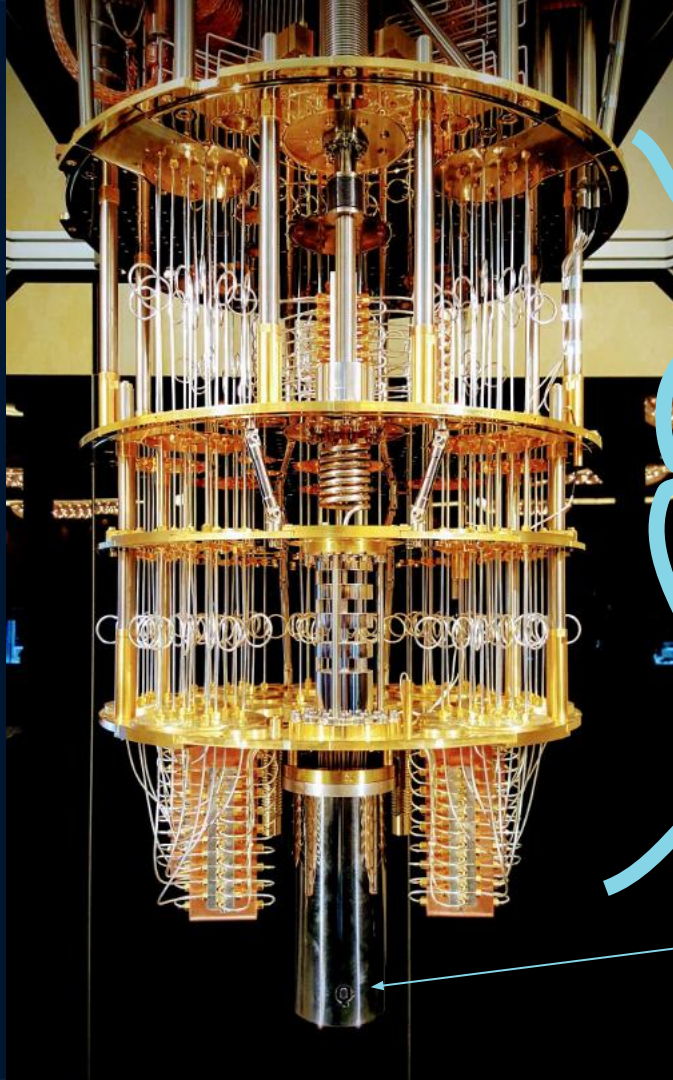
How does it work,
how will it affect us
and when?

John Fletcher, Staff Engineer
Lorenzo Petricone, IT-Consultant

@codecentric



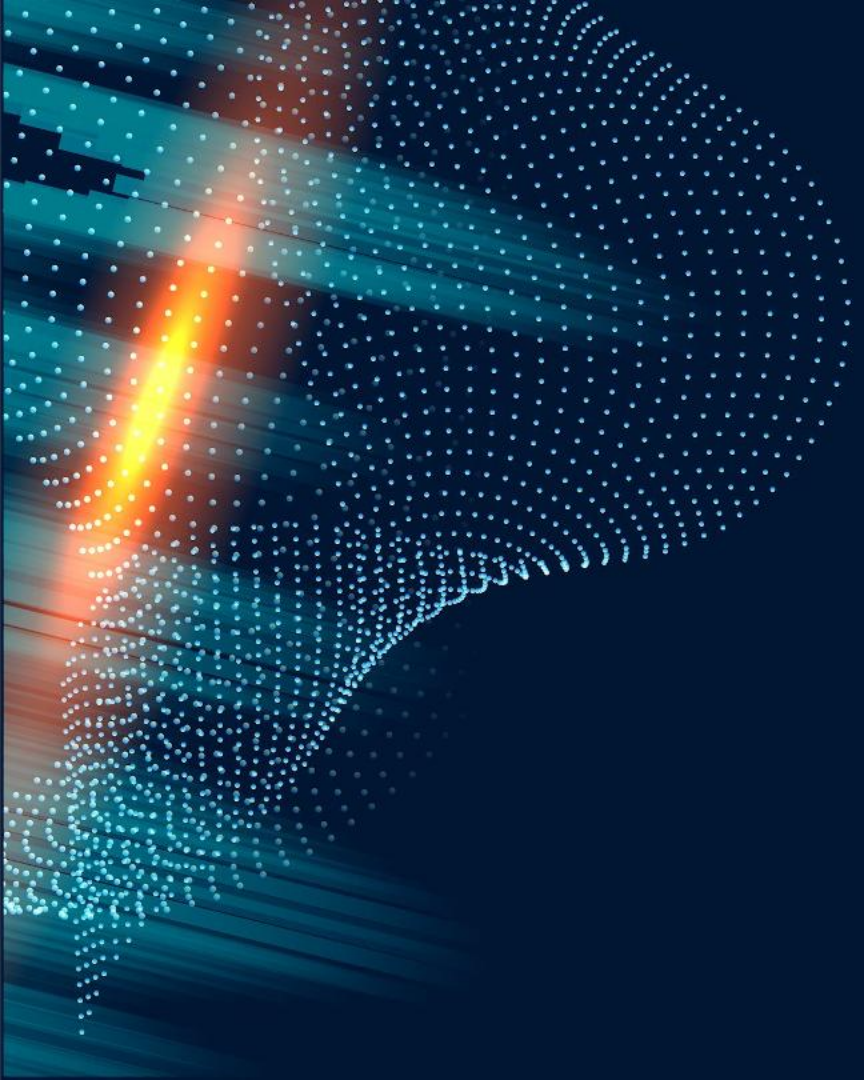
2025 was the
International
Year of Quantum
Science and
Technology



← Cooling

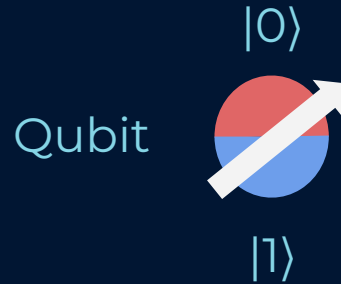
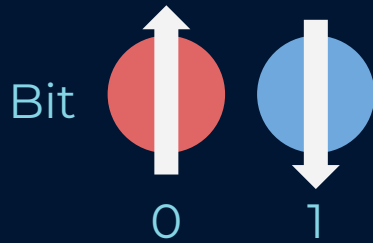
QPU



An abstract graphic on the left side of the slide, depicting a cross-section of a particle detector. It features a series of concentric, semi-circular layers of small white dots, representing detector segments. A bright, glowing orange and yellow track enters from the left, curving through the layers. The background is a dark blue gradient.

Wie?

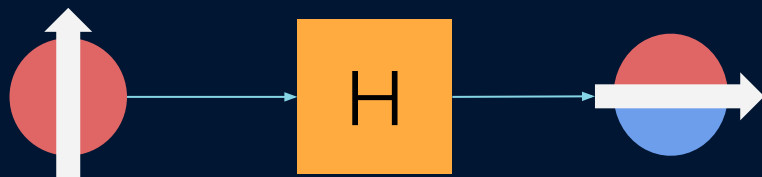
Quantum 101 - Superposition



$$|\psi\rangle = \alpha|0\rangle + \beta|1\rangle$$



Quantum 101 - Gates



Quantum 101 - Verschränkung

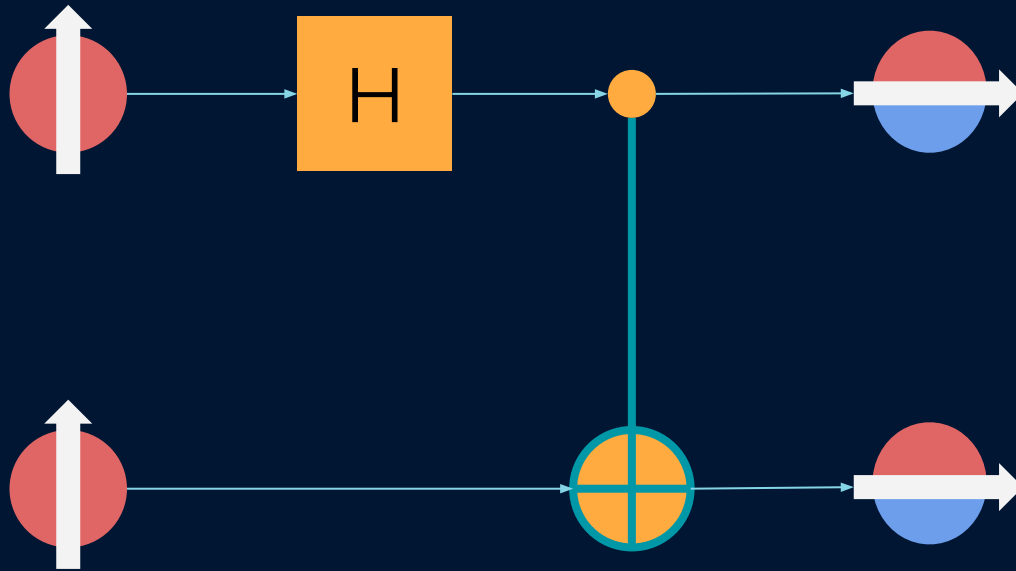


$$|\psi\rangle = \alpha|0\rangle + \beta|1\rangle$$

$$|\psi\rangle = \alpha_{00}|00\rangle + \alpha_{01}|01\rangle + \alpha_{10}|10\rangle + \alpha_{11}|11\rangle$$

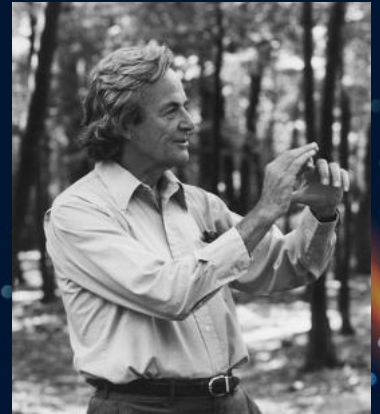


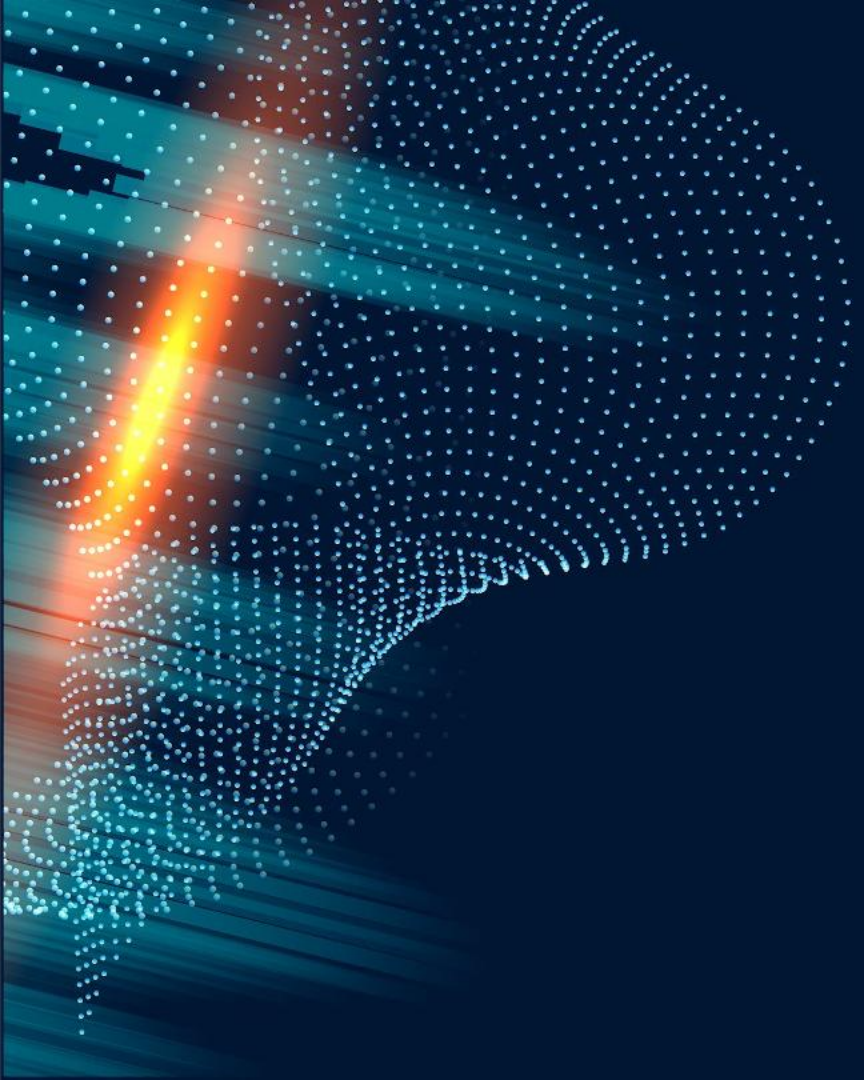
Quantum 101 - Circuit



**“I think I can safely say
that nobody
understands quantum
mechanics.”**

Richard Feynman



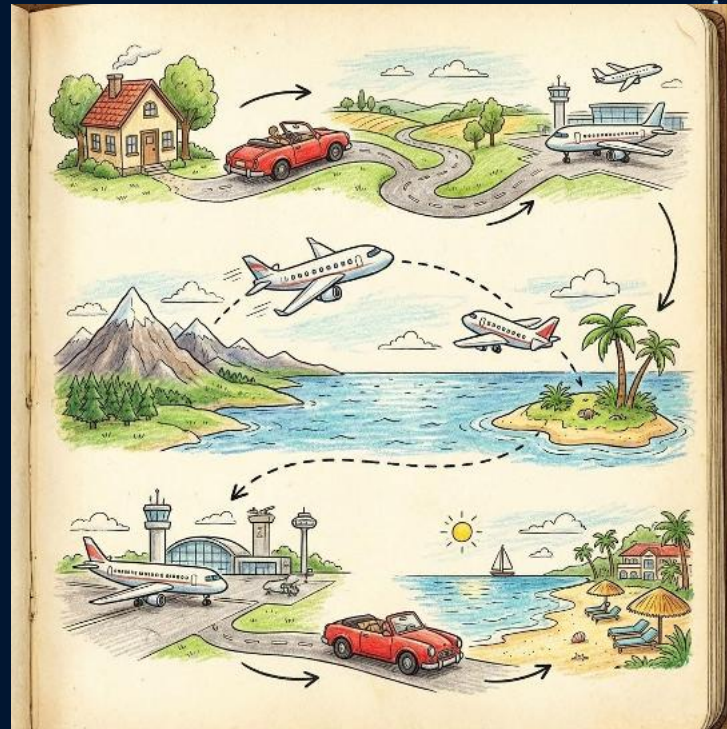


Wofür?

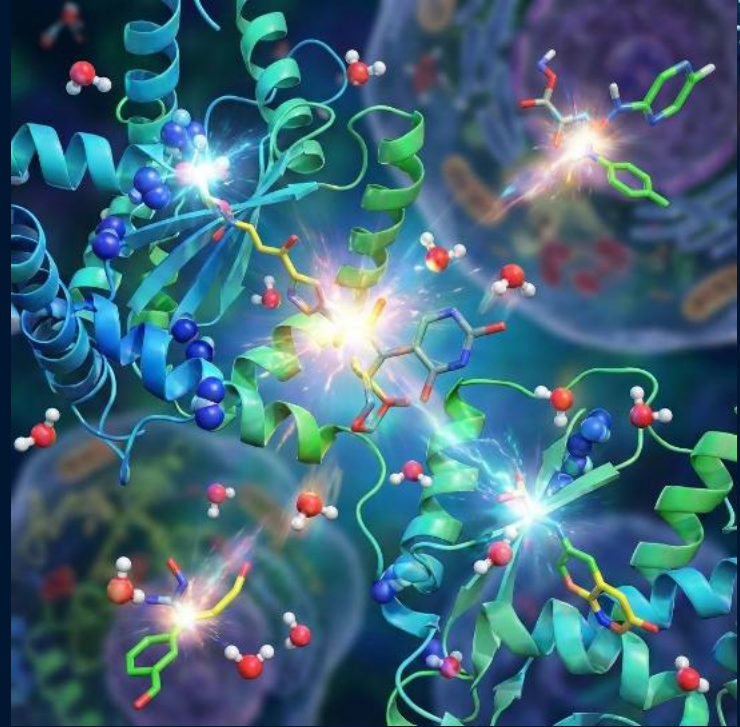
Wofür nicht?



Nur noch Quantencomputer?



Optimierung und Simulation



Riedbahn Sanierung

“Es gibt einige hochbelastete und störungsanfällige Korridore. Dort entstehen Verspätungen, die sich auf das gesamte Netz auswirken.”

- Deutsche Bahn



Kommunikation - Cyber Security

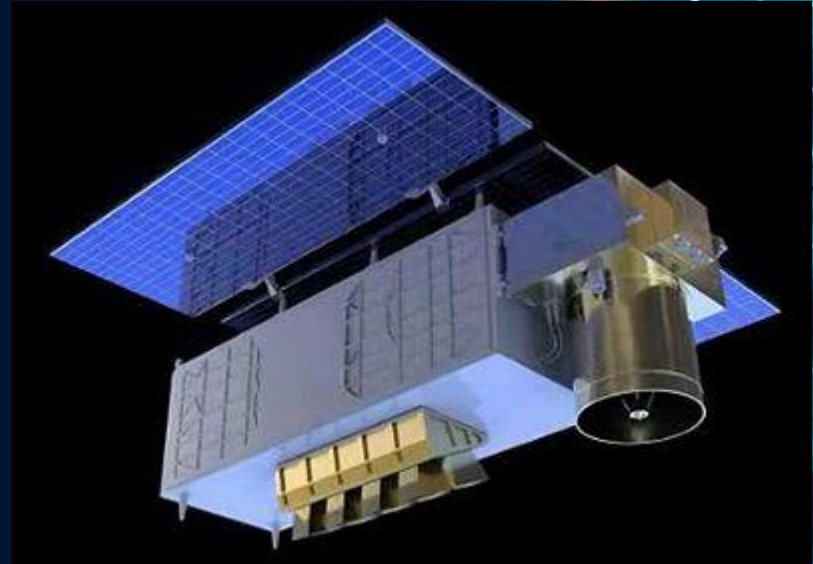


Quantum in Space

19 March 2025, *Nature*

Chinese Researchers have broken a distance record in quantum communication by sending a secret encryption key nearly 13,000 km from China to South Africa, using a cheap, lightweight 'microsatellite'.

Li, Y. et al., *Nature* <https://doi.org/10.1038/s41586-025-08739-z>, 2025



Krebs, Gunter D., "Jinan 1 (Diguidao Lianzi Mijiao Feixiao)", Gunter's Space Page, 2025

Globales Interesse

QuEra

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Opinion

Renewing America's Quantum Strategy for the Next Computing Era

August 20, 2025 • 2 min read

U.S. Commission On China Calls For 'Quantum First' National Goal By 2030, Recommends Significant Funding

National, Quantum Business, Research • Matt Swayne • November 18, 2025



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RESOURCE

Home > news > quantum computing and national security pentagons race against time

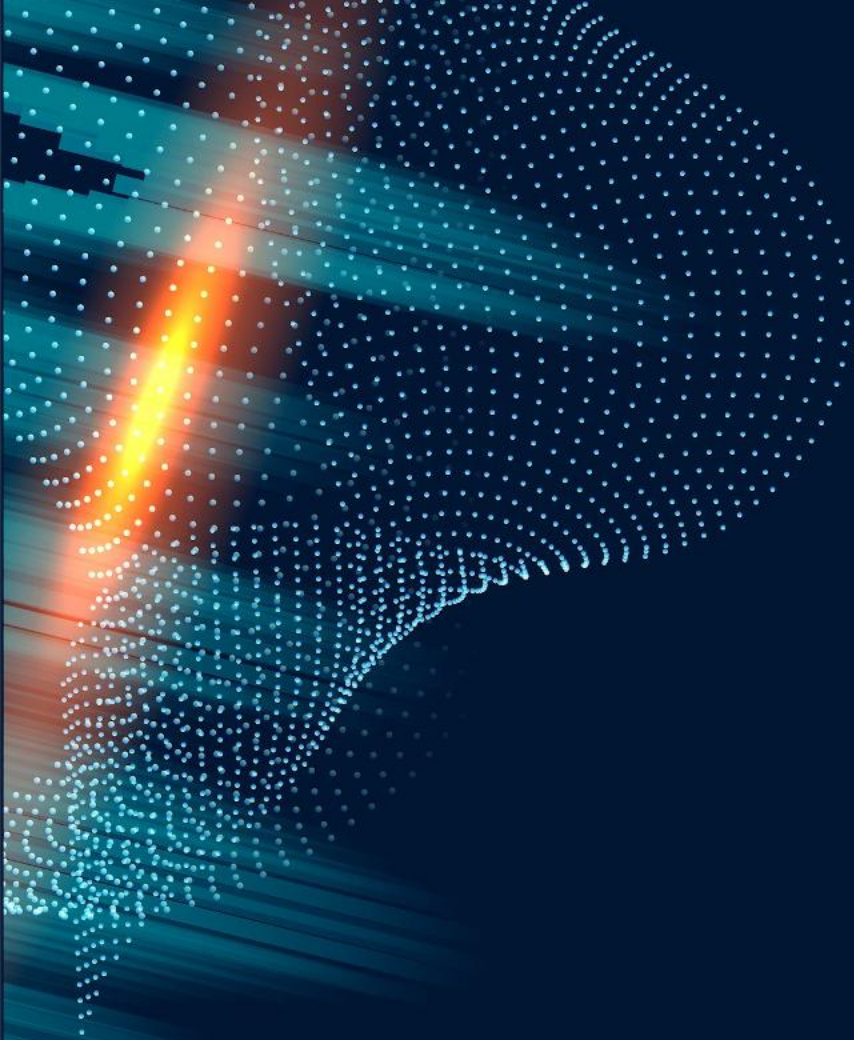
Quantum Computing and National Security: The Pentagon's Race Against Time

📅 June 06, 2025



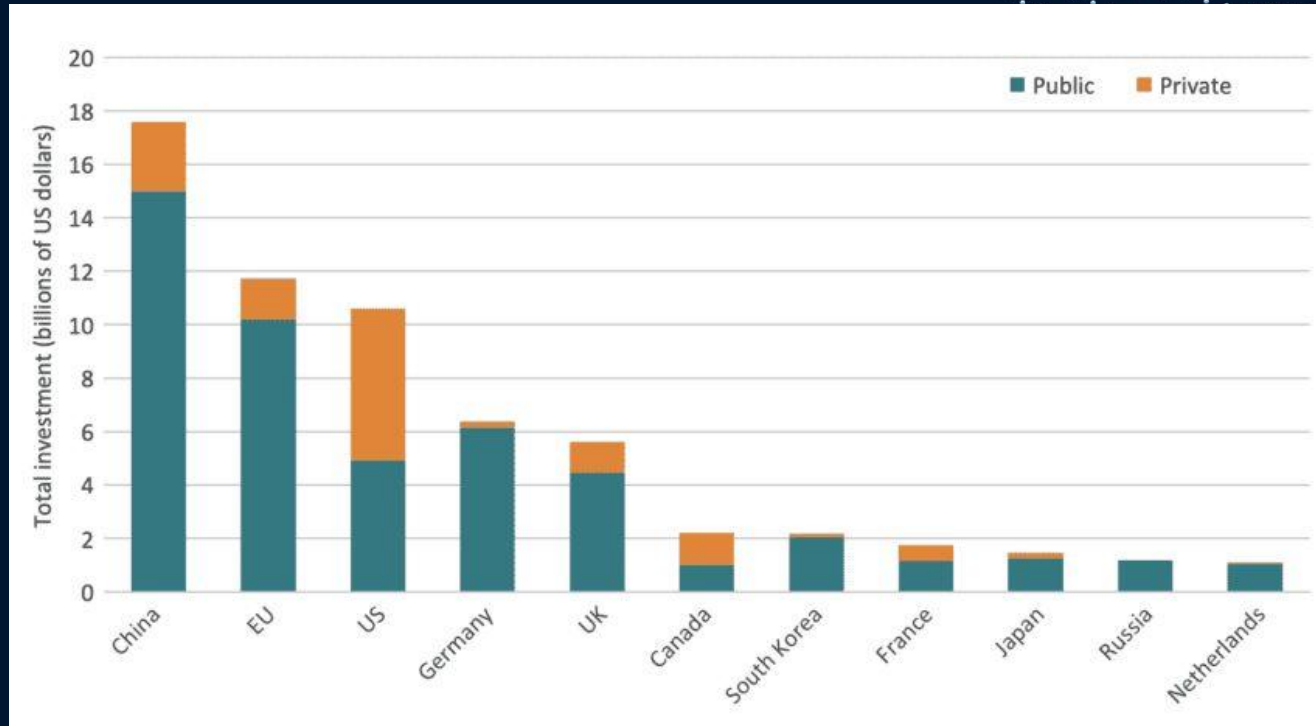
The Quantum Frontier: Shaping the Future of U.S. Strategic Dominance

Posted By *Morgan Nguyen* on Oct 10, 2025

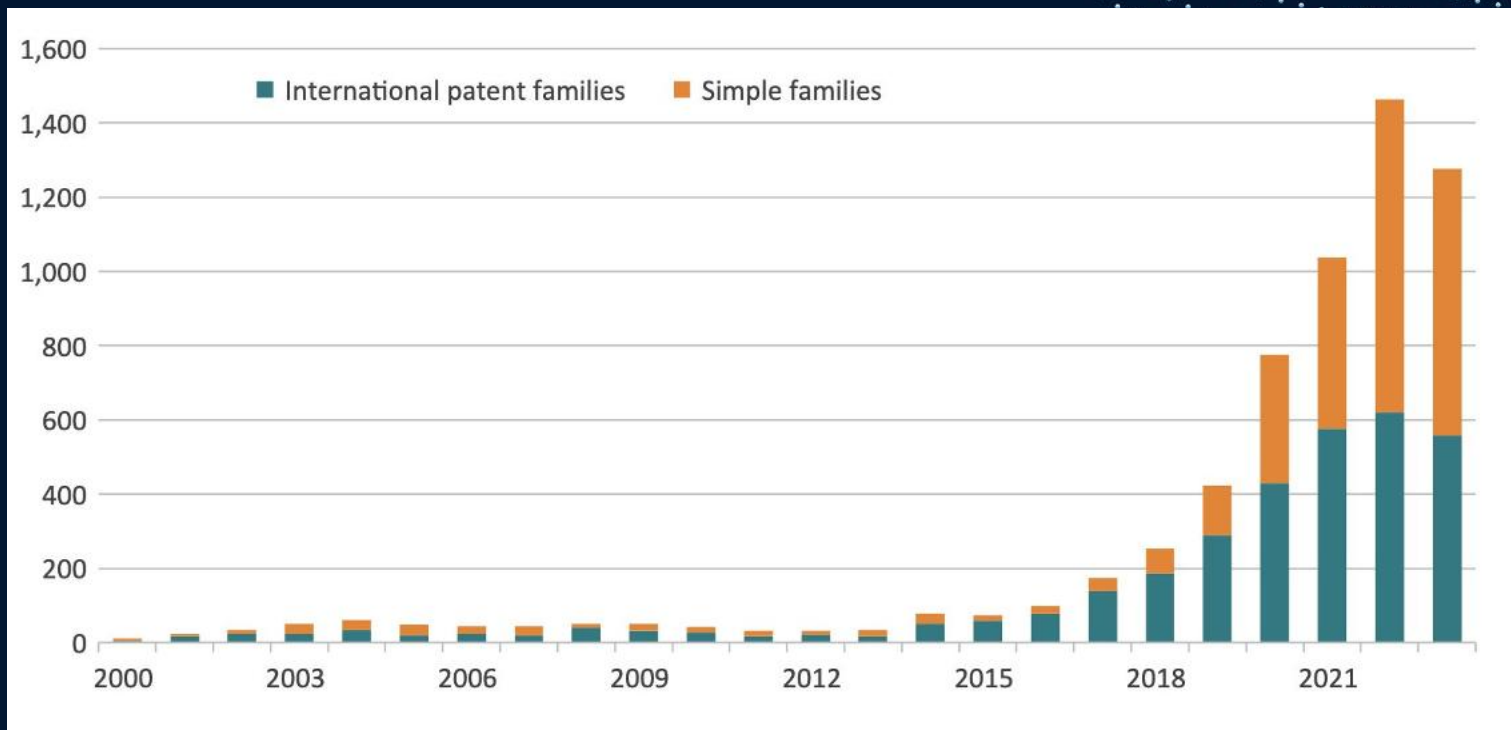


Wann?

Investitionen



Patente



Wann und warum noch nicht?

2016–2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2033+
Run quantum circuits on IBM Quantum Platform	Released multi-dimensional roadmap publicly with initial focus on scaling	Enhanced quantum execution speed by 100x with Qiskit Runtime	Brought dynamic circuits to unlock more computations	Enhanced quantum execution speed by 10x with Qiskit Serverless and execution modes	Demonstrated accurate simulation of a quantum circuit at a scale beyond what classical simulation (56 gates on 156 qubits)	Deliver quantum + HPC tools that will leverage Nighthawk, a new higher-conductivity quantum processor, able to execute more complex circuits	Enable the first examples of quantum advantage using a quantum computer with HPC	Improve quantum circuit quality to allow 30K gates	Improve quantum circuit quality to allow 15K gates	Deliver a fault-tolerant quantum computer with the ability to run 100M gates on 200 qubits	Beyond 2033, quantum computers will run circuits comprising a billion gates on up to 2000 qubits, unlocking the full power of quantum computing
Early	Falcon		Eagle		Heron (5K)	Nighthawk (5K)	Nighthawk (7.5K)	Nighthawk (10K)	Nighthawk (15K)	Starling (100M)	Blue Jay (1B)
Canary 9 qubits	Albatross 16 qubits	Penguin 28 qubits	Prototype 53 qubits	27 qubits	54 gates 156 qubits	5K gates 120 qubits	7.5K gates 120 qubits Up to 10K 360 qubits	10K gates 120 qubits Up to 10K 1000 qubits	15K gates 120 qubits Up to 10K 1,000 qubits	100M gates 200 qubits	1B gates 2000 qubits

Mandelbaum, "Scaling for quantum advantage and beyond", IBM, 2025

2024	2025	2026	2027	2028	2029	2030
36+ Physical Qubits 99.96% Physical Qubit Fidelity	64-100+ Physical Qubits 99.99% Physical Qubit Fidelity	100-256+ Physical Qubits 99.99% Physical Qubit Fidelity 12 Logical Qubits	10,000 Physical Qubits 99.99% Physical Qubit Fidelity 800 Logical Qubits	20,000 Physical Qubits 99.99% Physical Qubit Fidelity 1,600 Logical Qubits	Commercial Quantum Computers 200,000 Physical Qubits 99.99% Physical Qubit Fidelity 8,000 Logical Qubits	Commercial Quantum Computers 2,000,000 Physical Qubits 99.99% Physical Qubit Fidelity 80,000 Logical Qubits

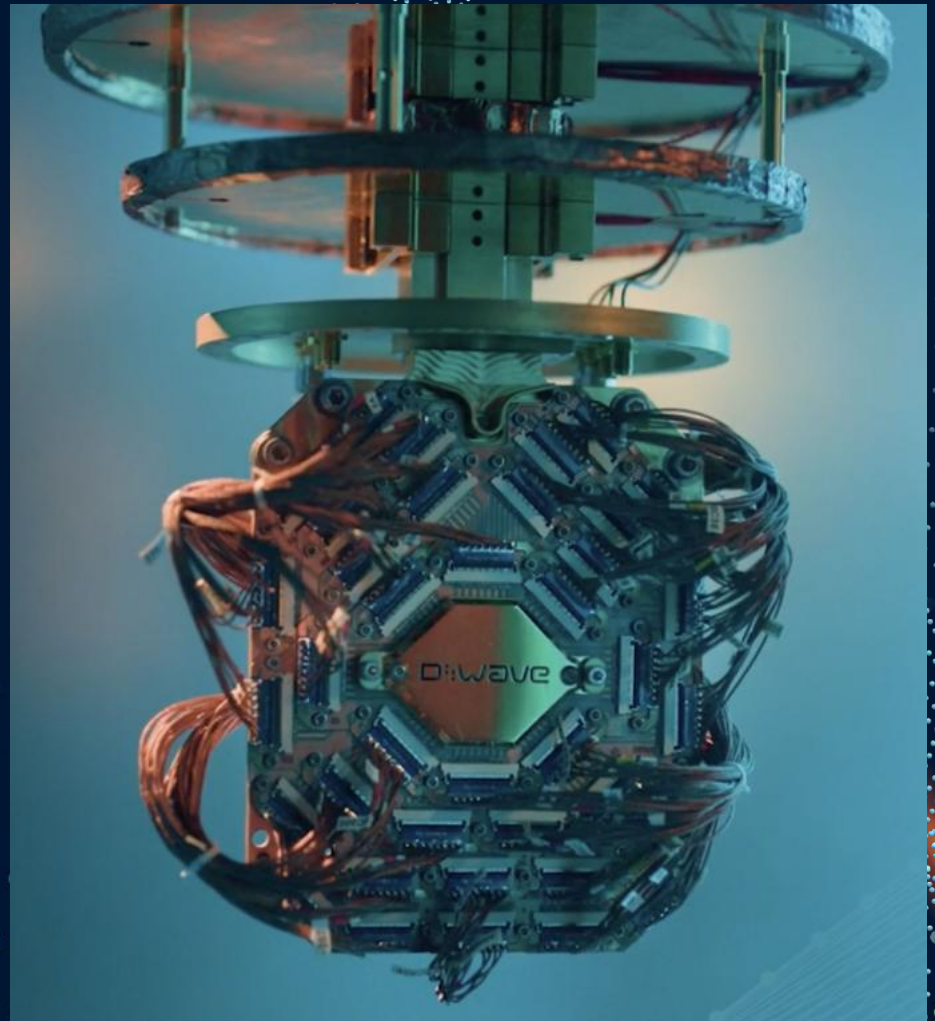
"IonQ's Accelerated Roadmap: Turning Quantum Ambition into Reality", IonQ, 2025



2030

Quantum
Computing-Ansätze lösen
eine begrenzte Menge an
Problemen eindeutig besser

**Quantum
Computing
wird heute
verkauft**



Cloud Quantum

IBM Quantum Platform
Get access to IBM quantum computers, Qiskit documentation,
and learning resources all in one place.

1 free hour of simulation time per month with AWS Braket

Amazon Braket

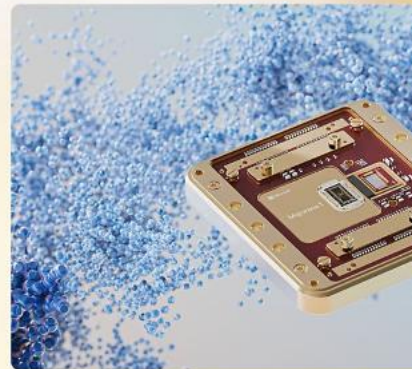
Accelerate quantum computing research

Azure Quantum

Experience the powerful synergy between Azure's high-performance computing, AI capabilities, and the transformative potential of quantum technologies, all designed to push the boundaries of innovation.

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Sovereign Quantum Computing



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QPU as a Service

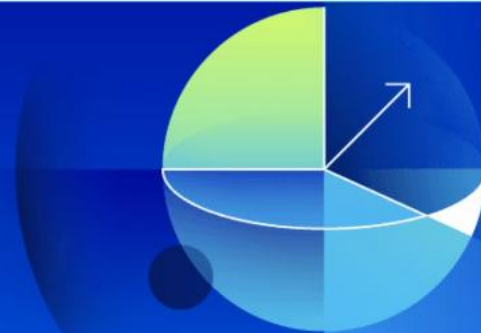
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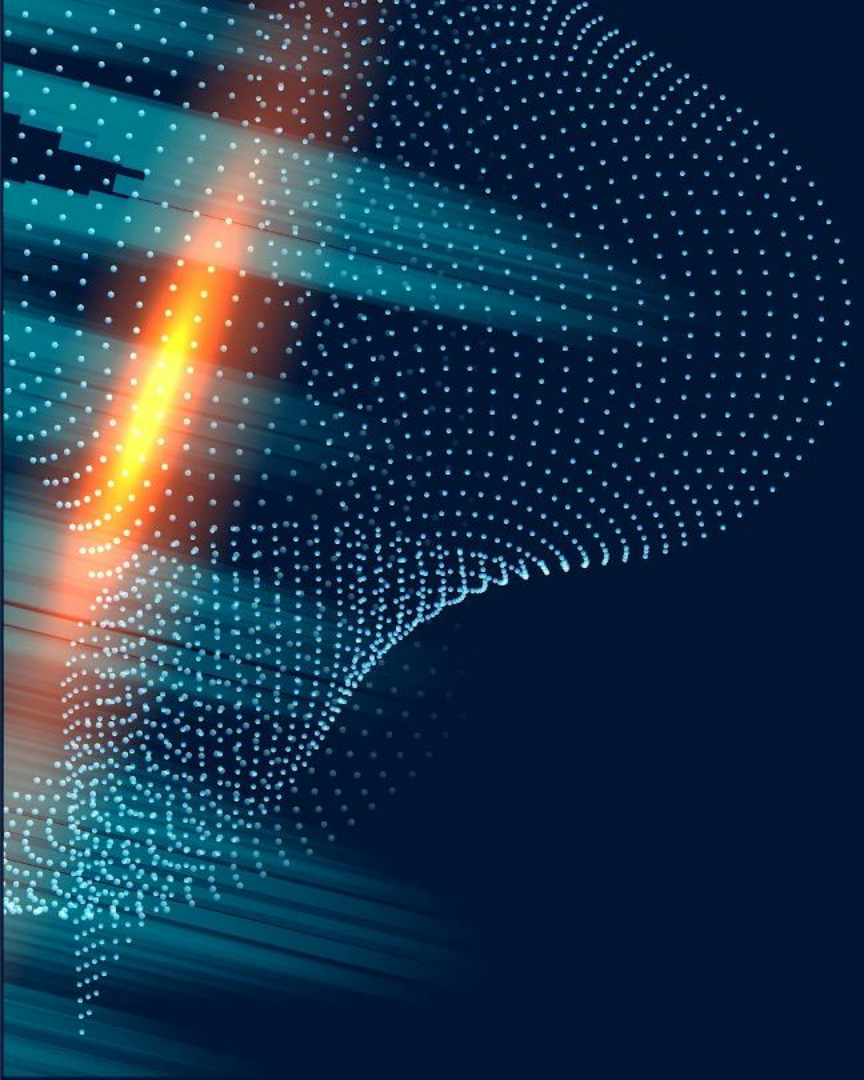
Quantum Processing Units (QPU)

Access real-world quantum computers through a unified cloud platform.
Test, refine and deploy your algorithms seamlessly, from simulation to execution.

[Get started](#)

[View prices](#)





Einfluss

Gesellschaft

- Gesundheitsrevolution
- Energiewende
- Datensicherheit
- Arbeitsmarktverschiebung
- Effizienzsteigerung



Unternehmen

- Nicht für alle relevant, eher für mittel bis große Unternehmen
- Wettbewerbsvorteil?
- Simulation
- Optimierung

Informatiker

- Post-Quantum-Cryptography - Heute
- Andere Denkweise für Problemstellungen - Nächsten Jahren
- Spezialisierung - Jederzeit



Die ultimative Anwendung ;)

Majorana 1 Explained: The Path to a Million Qubits



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Finally, a computer capable of running Microsoft Teams at full speed



21K



Reply



**John
Fletcher**

Staff Engineer



**Lorenzo
Petricone**

IT-Consultant

Bewertung



@codecentric

