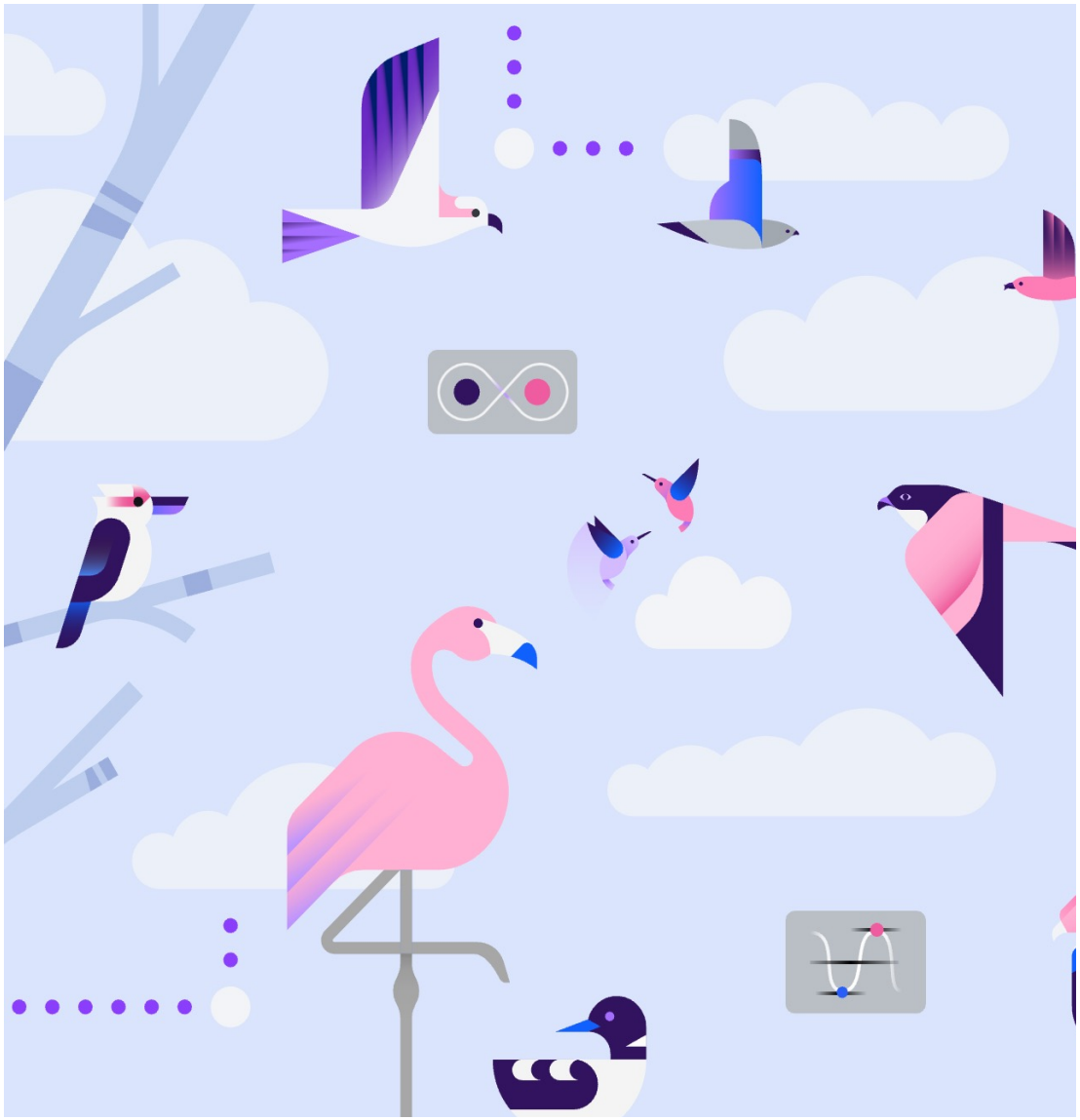
Introduction to IBM Quantum and Qiskit

Razvan Ghita
IBM Quantum Ambassador and Qiskit Advocate

Qiskit Fall Fest 2026



IBM Quantum mission

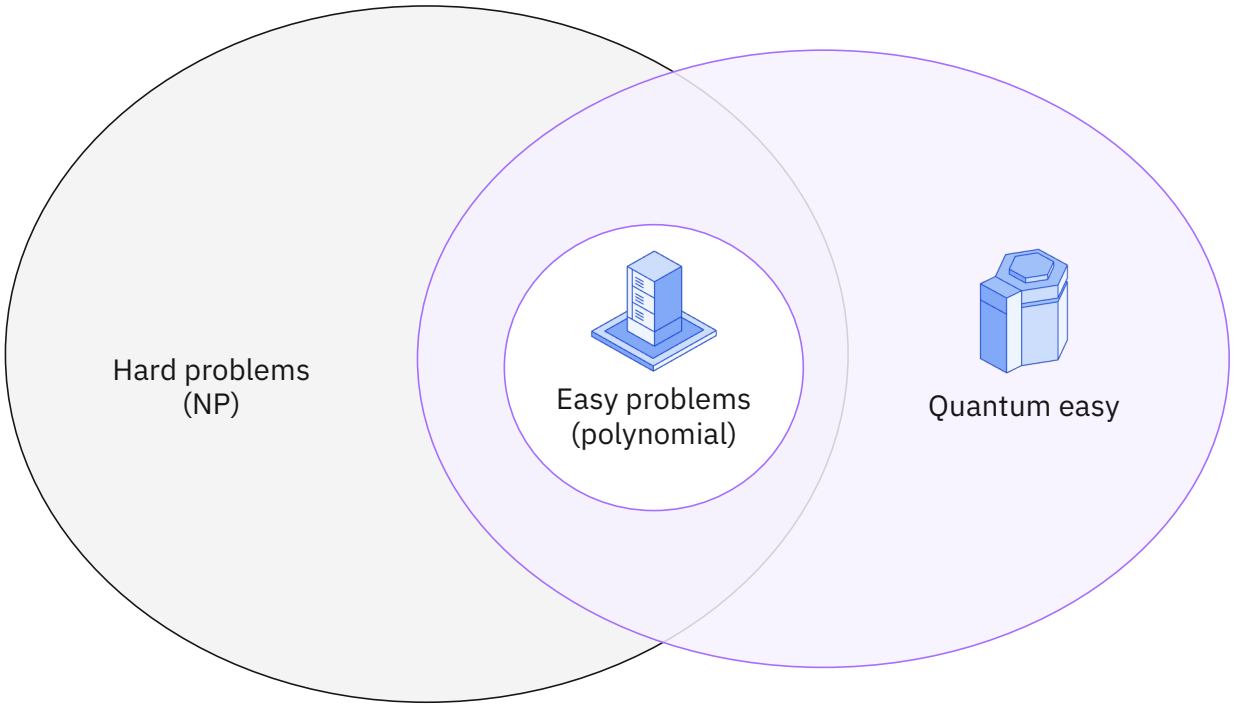
Bring useful quantum computing to the world



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There is a rich seam of problems that cannot be solved by classical and AI supercomputing, and never will.

These are the trillion-dollar problems that quantum computing was designed to solve.

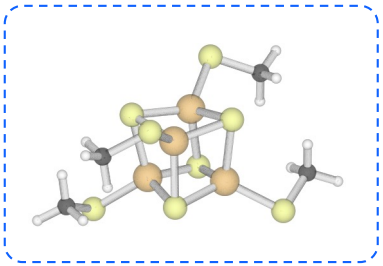


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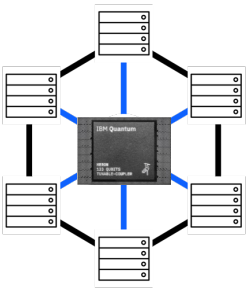
What are these problems?

Modeling molecules, atoms, electrons, and quarks with unprecedented accuracy





[4Fe-4S] using an active space of 54 electrons in 36 orbitals from the TZP-DKH basis set



$H\Psi = E\Psi$

Classical exact method	63 PiB of memory[1]
Classical approximate method (DMRG)	8 hours[2,3]
Quantum method (QCSC)	12 min using 77 qubits + 1.5 hours supercomputer time[1]

We are already using quantum (Heron, 77 qubits) and HPC (Supercomputer Fugaku) to achieve results comparable with the best classical approximate methods (DMRG) in accuracy and timing

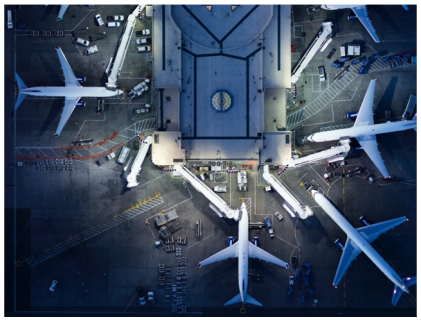
1. Science Advances vol. 11, no. 25 (2025)
2. J. Chem. Theory Comp. 20 (2024): 775–786
3. J. Chem. Phys. 159, 234801 (2023)

What are these problems?

Modeling molecules, atoms, electrons, and quarks with unprecedented accuracy



Developing lighter, longer-lasting batteries for electric vehicles, electronics, and energy grid storage



Designing lighter, stronger materials to allow planes to be more efficient and to need less maintenance



Discovering new classes of antibiotics to counter the emergence of multidrug-resistant bacterial strains



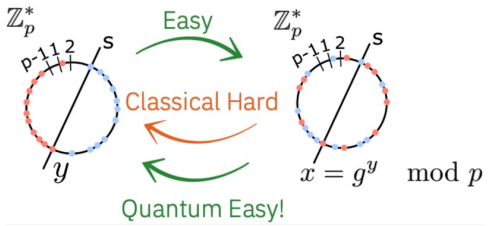
Designing optimal superconductors for MRI, electromobility, and renewable energies

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What are these problems?

Solving algebra in [exponential] spaces.
Finding hidden patterns in structured problems.

Groups encode symmetries and transformations of data.



$$f(g\mathbf{b}) = f(g) \qquad \forall\ \mathbf{b} \in B$$

$$= \frac{1}{\sqrt{|G|}} \sum_{g \in G} |f(g)\rangle |g\rangle$$

$$= \sqrt{\frac{|B|}{|G|}} \sum_{g_0 \in G/B} |f(g_0)\rangle \frac{1}{\sqrt{|B|}} \sum_{\mathbf{b} \in B} |g_0 \mathbf{b}\rangle$$

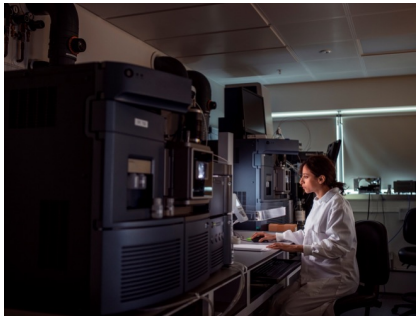
Quantum computers speak the mathematics of group theory and work in the large spaces needed to answer difficult computational problems inaccessible to classical methods.

What are these problems?

Solving algebra in [exponential] spaces.
Finding hidden patterns in structured problems.



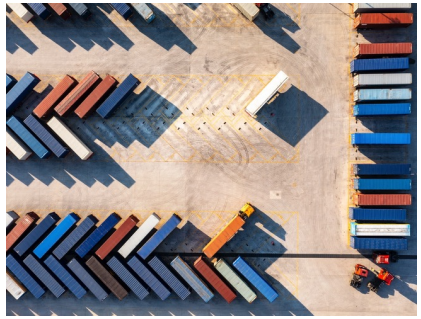
Improving anomaly detection, as for rare events detection and fraud detection



Improving patient outcomes by designing optimal cell-centric therapeutics



Strengthening risk management through better time series and sequence prediction



Optimizing vehicle routing and scheduling for large-scale logistics networks

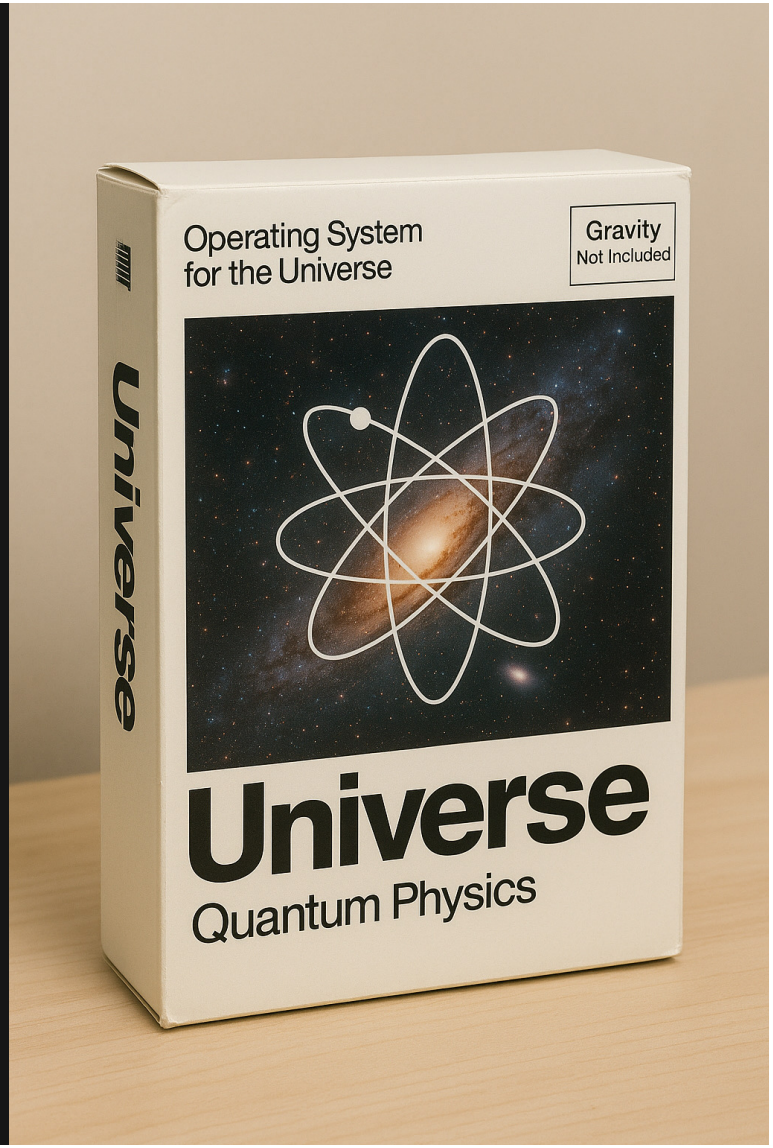
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Nature is quantum.

↓

You need quantum to simulate nature.

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And we know there are other problems with a structure that quantum can exploit.

↳ So we're also looking for value in problems that are hard classically, like optimization.

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State of the technology

Quantum Utility



All circuits can be brute force run on classical hardware



Only approximate solutions exists and is the regime for exploring quantum advantage

Well in the error correction regime where today's known quantum algorithms exist




```
for _ in loop:
    qc,matrix,… = do_classical(param)
    A,… = SGESVD(matrix)
    job = sampler.run([qc])
    do_classical(job.result(), A, …)
    …
```

Thesis

The future of computing is mapping all problems to tensors and circuits

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What is quantum advantage?

Performing an information processing task more efficiently, cost-effectively, or accurately using quantum computers than is known to be possible with classical computers alone

There are two important nuances to this →

1

We must establish trust in the outputs of a real and noisy quantum device.

A scientific experiment is only as good as confidence in methods.

2

Quantum advantage is not something that will happen at a singular moment in time.

It is a hypothesis that is subject to falsification.

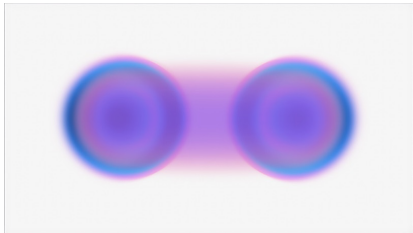
What is quantum computing?

Uniquely quantum

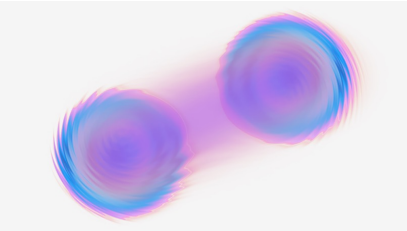
Some problems are classically intractable and will never be solvable with traditional computers



Superposition
A quantum system existing in a complex linear combination of two states until it is measured



Entanglement
Information shared jointly between entangled pairs or groups



Interference
Interaction that affects likelihood of solutions

Moore's law: the number of transistors in a classical integrated circuit doubles about every two years
... but we are approaching the end due to physical limitations

Approaching the physical limit: IBM created the world's first 2 nm node chip in 2021, with transistors as small as 10 silicon atoms

These Quantum concepts can reduce the number of computational steps required for certain algorithms
&
At a ~100 qubit scale, with sufficient circuit depth and complexity, classical computers can no longer simulate exactly

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The limit of bits

IBM Quantum

For decades we've been simplifying nature into **1**s and **0**s because that was the only way we could **manage** to create a useful and scalable system of computation.

00100110111001001000100100100110010011100101110011111100101001000111001000100101000100100101010100101010111001001101110010001001001001100100111001011111001000101001000111000100010010100100101010111011100111001010111110

IBM Quantum © 2024 IBM Corporation

The limit of bits

IBM Quantum

For decades we've been simplifying nature into **1**s and **0**s because that was the only way we could **manage** to create a useful and scalable system of computation.

```
00100110111001001000100100100110010011
00101110011111001010010001110001000100
10000100100101010100101010111001001101
10010010001001001001100100111001011100
11110010100100011100010001001010001001
01010101001010101110111001110010101111
```

But the future isn't just **1**s and **0**s.

IBM Quantum © 2024 IBM Corporation

Bits and classical logic circuits

IBM **Quantum**

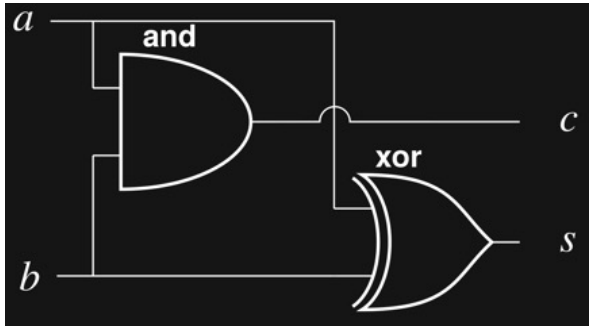
0

•

•

1

A bit is a controllable classical object that is the unit of information

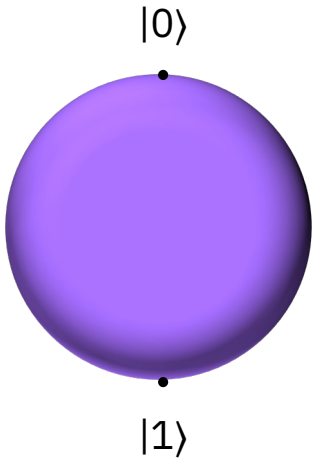


A classical logic circuit is a set of gate operations on bits and is the unit of computation

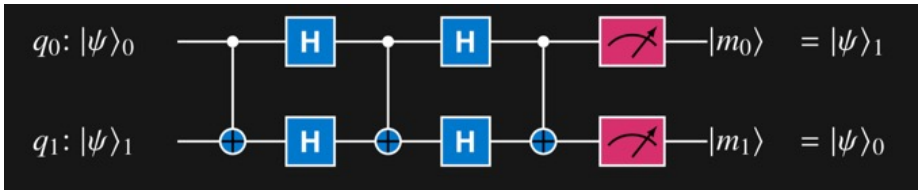
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Quantum bits (qubits) and quantum circuits

IBM **Quantum**



A quantum bit or qubit is a controllable quantum object that is the unit of information

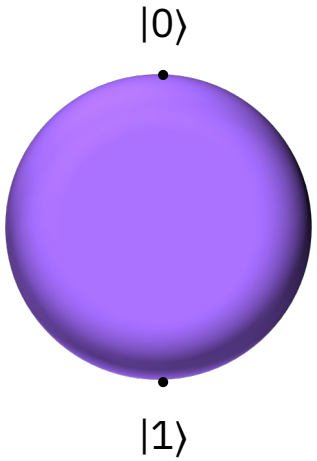


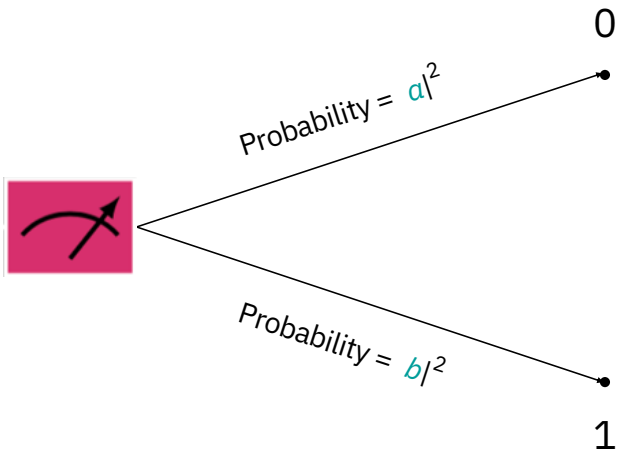
A quantum circuit is a set of quantum gate operations on qubits and is the unit of computation

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Bits and qubits

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A qubit's state is a combination of |0⟩ and |1⟩:

$a\,|0\rangle + b\,|1\rangle$

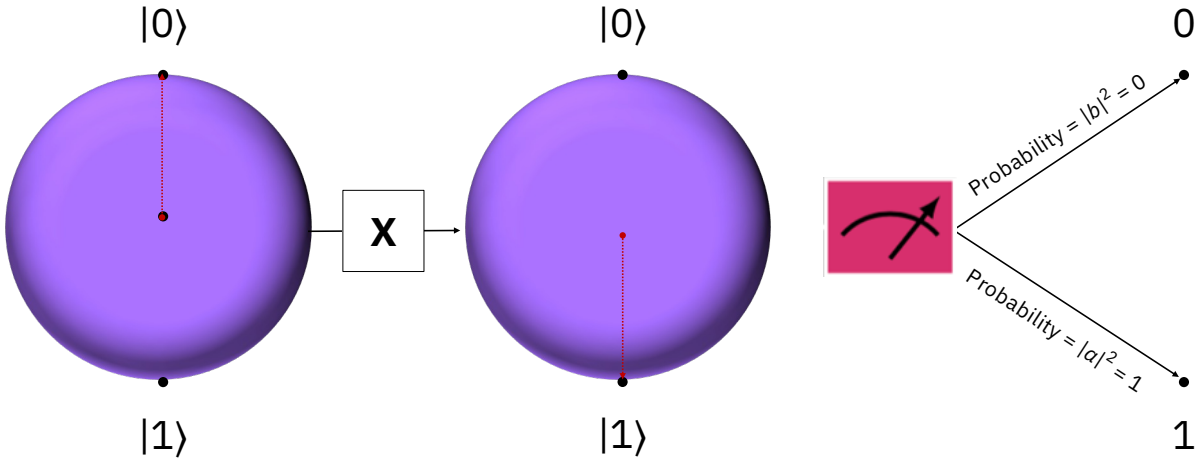
This means that a single qubit contains two pieces of information.

When we measure a qubit, it becomes **0** or **1** based on probability.

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Bits and qubits: the effect of the X gate on |0⟩

IBM **Quantum**



The **X** gate reverses |0⟩ and |1⟩:

$a\,|0\rangle + b\,|1\rangle \;\mapsto\; b\,|0\rangle + a\,|1\rangle$

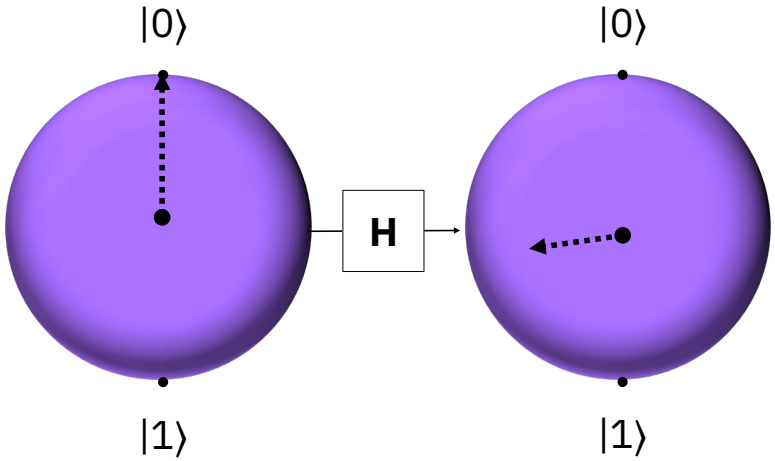
$a = 1$ and $b = 0$, so $|0\rangle$ is mapped to $|1\rangle$.

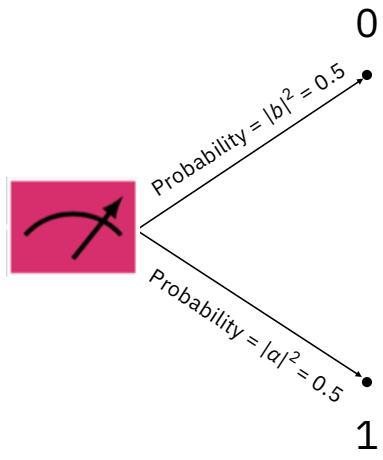
When measured, the result is **1** with 100% probability.

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Bits and qubits: the effect of the **H** gate on |0⟩

IBM **Quantum**





The **H** gate maps |0⟩ via

$|0\rangle \mapsto (1/\sqrt{2})\,|0\rangle + (1/\sqrt{2})\,|1\rangle = a\,|0\rangle + b\,|1\rangle$

Since $a = b = 1/\sqrt{2}$, $|a|^2 = |b|^2 = ½$.

When measured, the probability of getting **0** or **1** is the same, 0.5.

Quantum randomness!

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Quantum computing uses essential ideas from quantum mechanics

Superposition

$|0\rangle$ and $|1\rangle$ are vectors in the two-dimensional complex vector space $\mathbb{C}^2$:

$$|0\rangle = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \quad \text{and} \quad |1\rangle = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

So we can write any vector in $\mathbb{C}^2$ as

$$a\,|0\rangle + b\,|1\rangle$$

We pronounce $|0\rangle$ and $|1\rangle$ as “ket zero” and “ket one.” These are called the *computational basis*.

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Quantum computing uses essential ideas from quantum mechanics

Superposition

Superposition is creating a quantum state that is a combination of $|0\rangle$ and $|1\rangle$

$$a\,|0\rangle + b\,|1\rangle$$

where

a and b are complex numbers

$|a|^2 + |b|^2 = 1$

Two quantum states are equivalent if they differ only by a constant multiple u where $|u| = 1$.

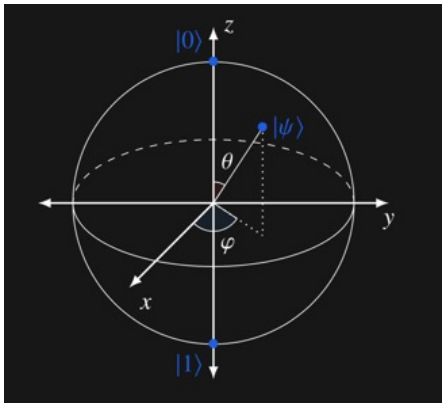
This is because

$$|a|^2 + |b|^2 = |au|^2 + |bu|^2 = 1$$

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Quantum computing uses essential ideas from quantum mechanics

Superposition



Superposition is creating a quantum state that is a combination of |0⟩ and |1⟩

$$a\,|0\rangle + b\,|1\rangle$$

These conditions allow us to map the qubit onto the *Bloch Sphere*.

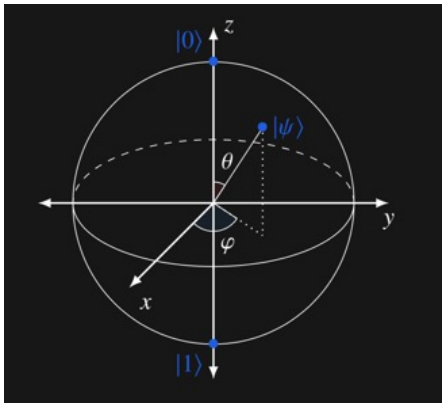
Note that if a and b are non-zero, then the qubit's state contains both |0⟩ and |1⟩.

This is what people mean when they say that a qubit can be "0 and 1 at the same time."

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Quantum computing uses essential ideas from quantum mechanics

Measurement



Measurement is forcing the qubit's state

$$a\,|0\rangle + b\,|1\rangle$$

to $|0\rangle$ or $|1\rangle$ by observing it, where

- $|a|^2$ is the probability we will get $|0\rangle$ when we measure
- $|b|^2$ is the probability we will get $|1\rangle$ when we measure

For example,

$$\frac{\sqrt{2}}{2}|0\rangle + \frac{\sqrt{2}}{2}|1\rangle$$

has an equal probability of becoming $|0\rangle$ or $|1\rangle$, and

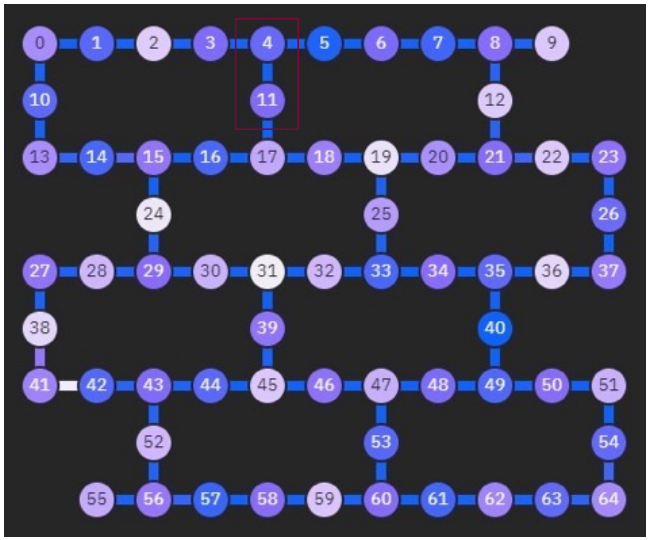
$$\frac{\sqrt{3}}{2}|0\rangle - \frac{1}{2}i\,|1\rangle$$

has a 75% chance of becoming $|0\rangle$.

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Quantum computing uses essential ideas from quantum mechanics

Entanglement



With two qubits we get combinations like

$$a\,|00\rangle + b\,|01\rangle + c\,|10\rangle + d\,|11\rangle$$

where

$|01\rangle$ means the first qubit is $|0\rangle$ and the second is $|1\rangle$

a, b, c and d are complex numbers and

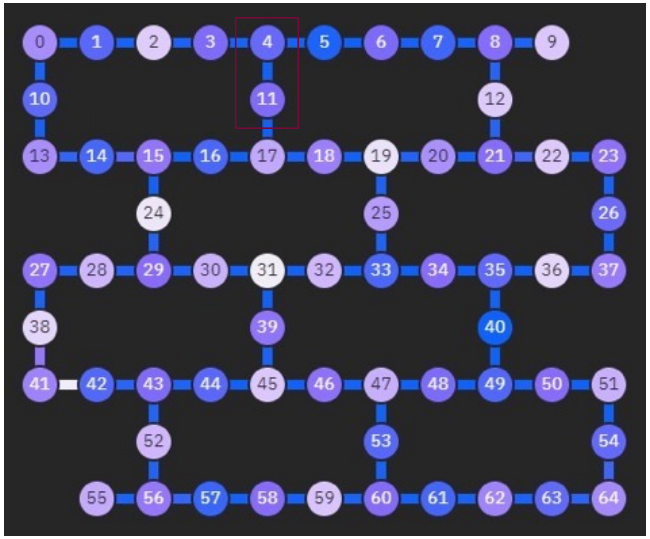
$$|a|^2 + |b|^2 + |c|^2 + |d|^2 = 1$$

If two or more of the a, b, c, and d are non-zero, and we cannot separate the qubits, they are entangled with perfect correlation and are no longer independent.

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Quantum computing uses essential ideas from quantum mechanics

Entanglement



For example,

$\frac{\sqrt{2}}{2}|00\rangle + \frac{\sqrt{2}}{2}|01\rangle$ not entangled

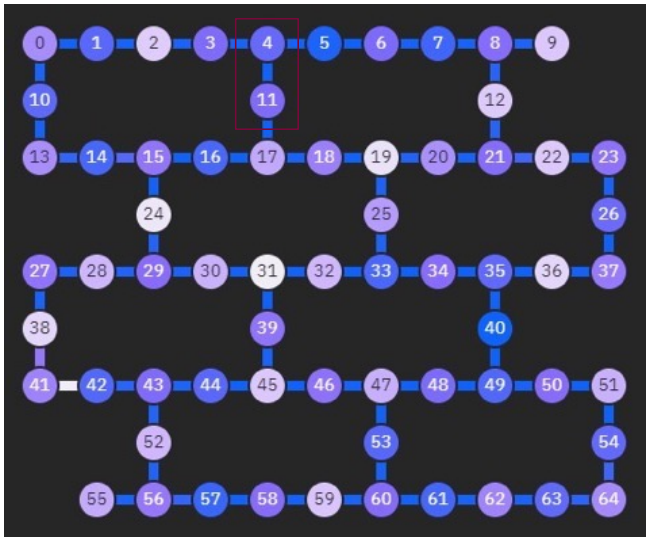
$\frac{\sqrt{2}}{2}|01\rangle - \frac{\sqrt{2}}{2}|10\rangle$ entangled

$\frac{\sqrt{2}}{2}|00\rangle + \frac{\sqrt{2}}{2}|11\rangle$ entangled

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Quantum computing uses essential ideas from quantum mechanics

Entanglement



We can write

$$\frac{\sqrt{2}}{2}|00\rangle + \frac{\sqrt{2}}{2}|01\rangle$$

as

$$|0\rangle \left(\frac{\sqrt{2}}{2}|0\rangle + \frac{\sqrt{2}}{2}|1\rangle\right)$$

but we cannot write

$$\frac{\sqrt{2}}{2}|00\rangle + \frac{\sqrt{2}}{2}|11\rangle$$

as the “product” of two single qubit states.

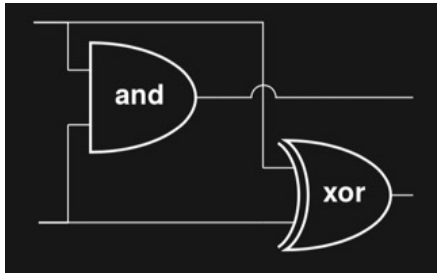
They are entangled!

Once you measure the first qubit, the second is uniquely determined.

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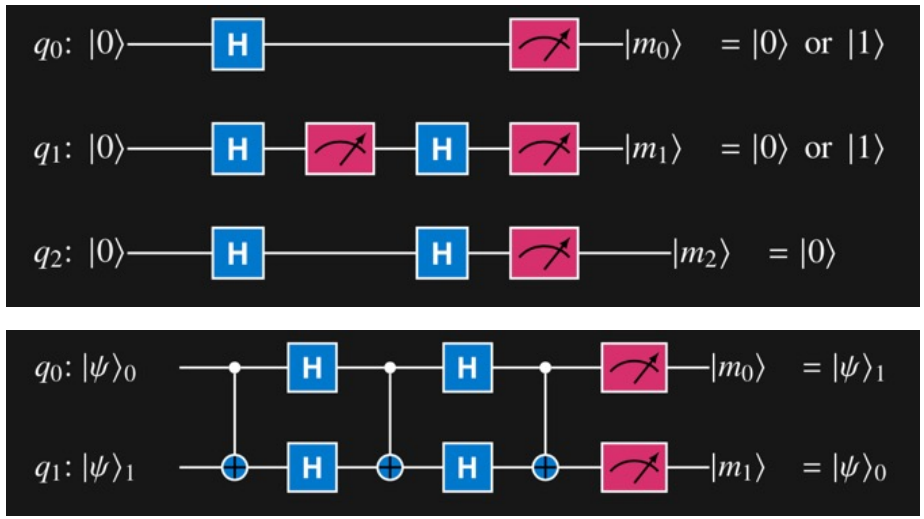
Quantum computing uses essential ideas from quantum mechanics

Gates / operations



Classical logical circuits use operations like and, or, not, nand, and xor. We also call these gates.

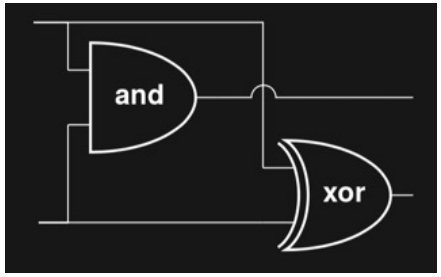
Quantum circuits use reversible gates that change the quantum states of one, two , or more qubits.



IBM Quantum © 2024 IBM Corporation

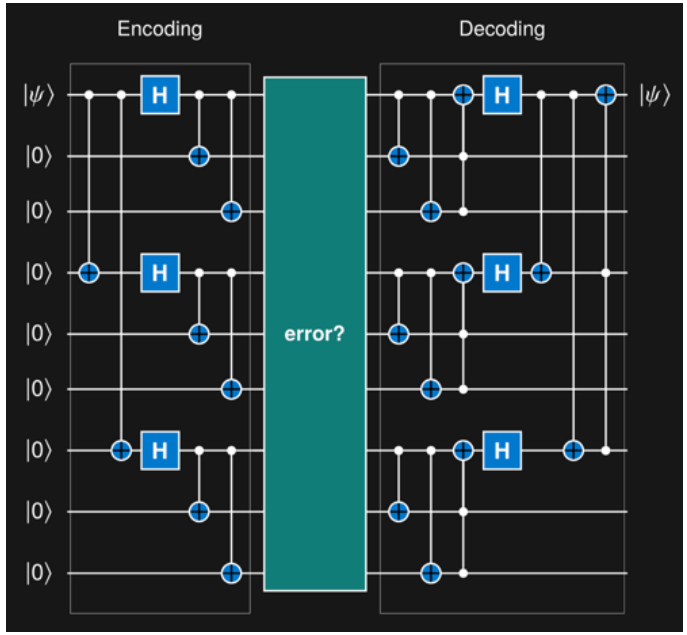
Quantum computing uses essential ideas from quantum mechanics

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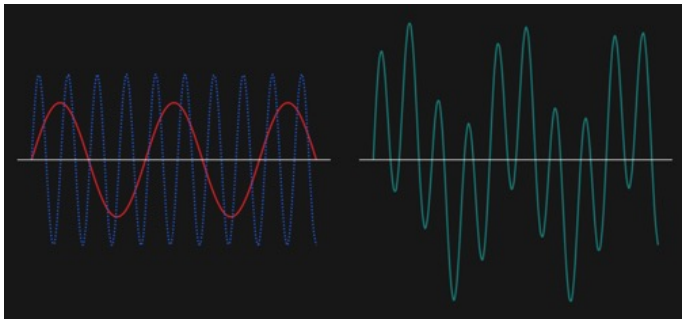
Quantum circuits use reversible gates that change the quantum states of one, two , or more qubits.



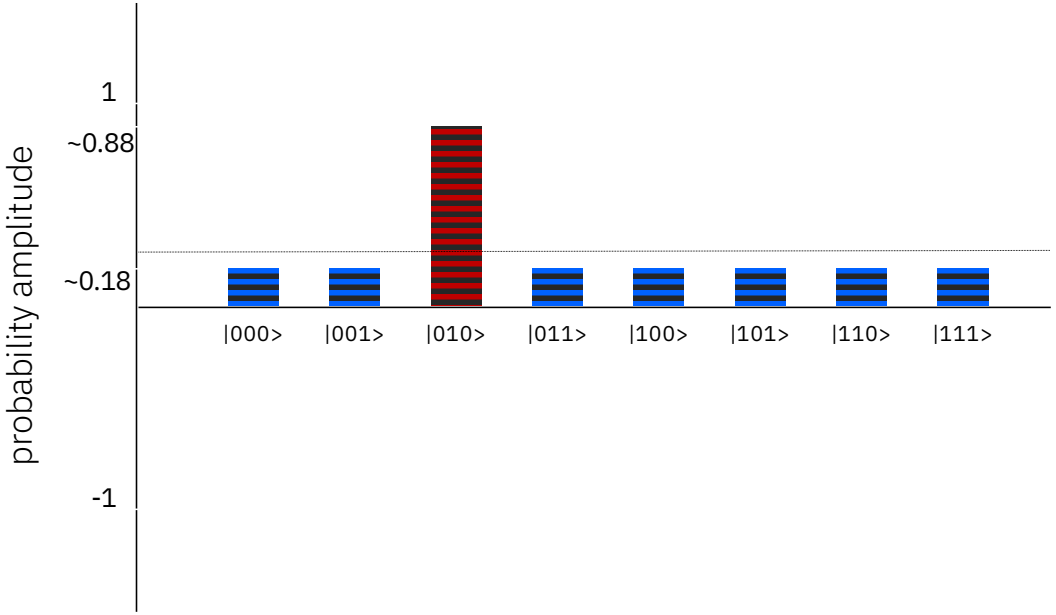
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Quantum computing uses essential ideas from quantum mechanics

Interference



Interference allows us to increase the probability of getting the right answer and decrease the chance of getting the wrong one.

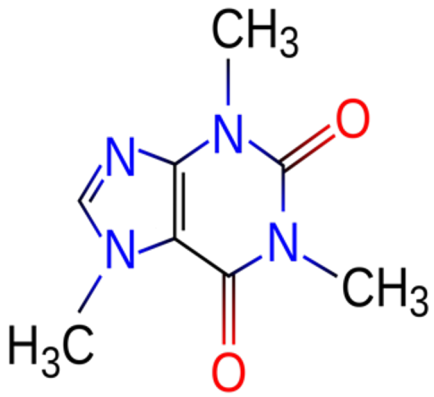


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Computing with caffeine

If our best classical computers are so powerful, shouldn’t we be able to perfectly simulate molecules and chemical reactions?
This would allow us to accelerate discovery of new compounds and processes for healthcare, materials, alloys, and sustainable energy creation.
Let’s consider caffeine …





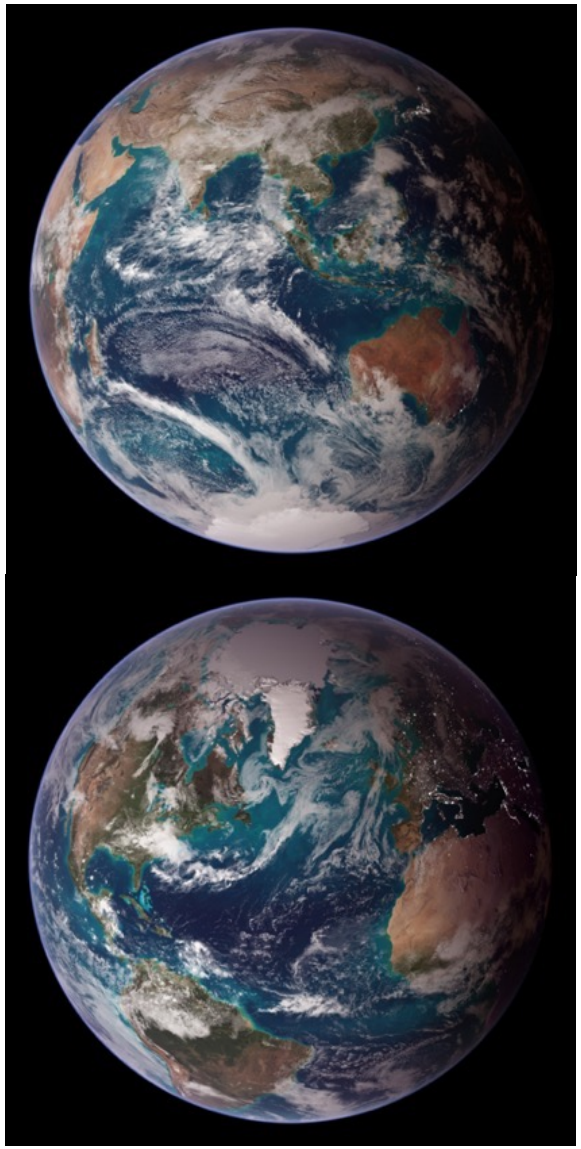
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Computing with caffeine

We would need approximately 10^{48} bits to represent the energy configuration of a single caffeine molecule at a single instant in a classical computer.

This is 1 to 10% of the total number of atoms in the Earth.

10^{48} = 1,000,000,000,000,000,
000,000,000,000,000,000,
000,000,000,000,000



IBM Quantum © 2024 IBM Corporation

Computing with caffeine

Although it’s impossible to completely represent the molecular configuration of caffeine on today’s most powerful super computers, we could represent it using 160 logical qubits.



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The new wave of computing



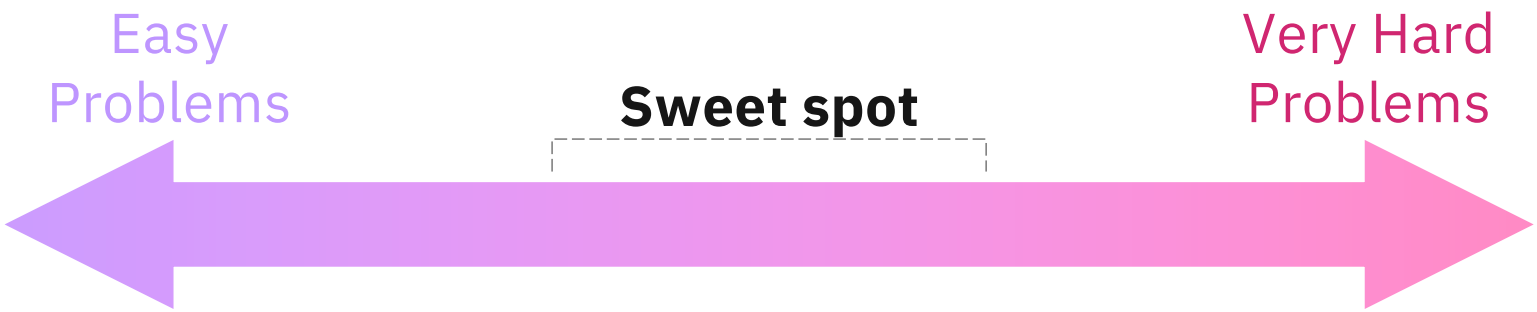
Classical computer
Well suited for many problems



Quantum computer
Unlock classically intractable problems

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When to use a quantum computer



No need for QC

Arithmetic
video games

Need fault-tolerant QC

Shor's Algorithm
Grovers Algorithm

See Quantum Computing in Practice | Which Problems Are Quantum Computers Good For? for additional discussion and insights

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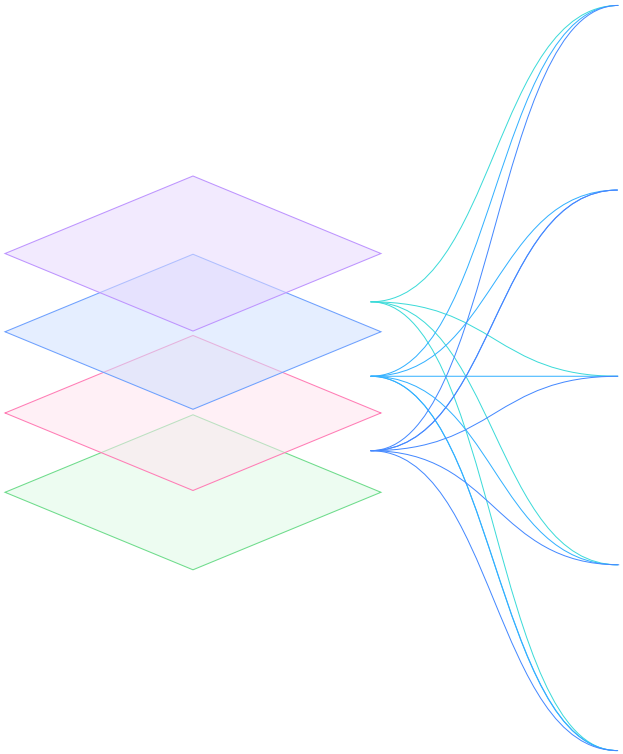
Quantum computing is expected to have impact across industries

Example use cases

Nearer Term

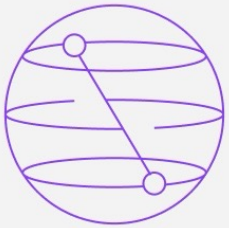
Longer Term

- Chemistry & materials
- Optimization & Search
- Machine Learning/AI
- Numerical simulation

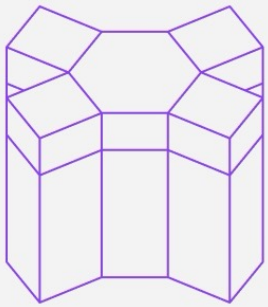


Aerospace	• High strength-to-weight materials development • Wing ply-composite design optimization • Aircraft computational fluid dynamics
Automotive	• Advanced batteries • Multi-objective vehicle routing optimization • Auto design and simulation
Chemicals	• Lower energy fertilizer manufacturing • Efficient Catalysts • Accelerated product development
Electronics & semiconductors	• Placement and routing optimization • Deposition/etch process modeling • Multi-domain simulation
Energy	• Grid management • Grid optimization with EV's • Carbon Sequestration
Financial Services	• Portfolio optimization • Derivatives/options pricing • Antti-Money laundering
Health Care & Life Sciences	• Drug discovery and drug design optimization • mRNA & protein structure predictions • Disease target & biomarker discovery

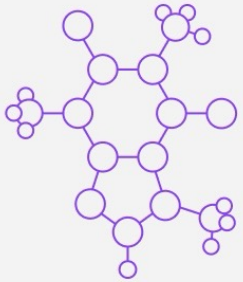
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Qiskit



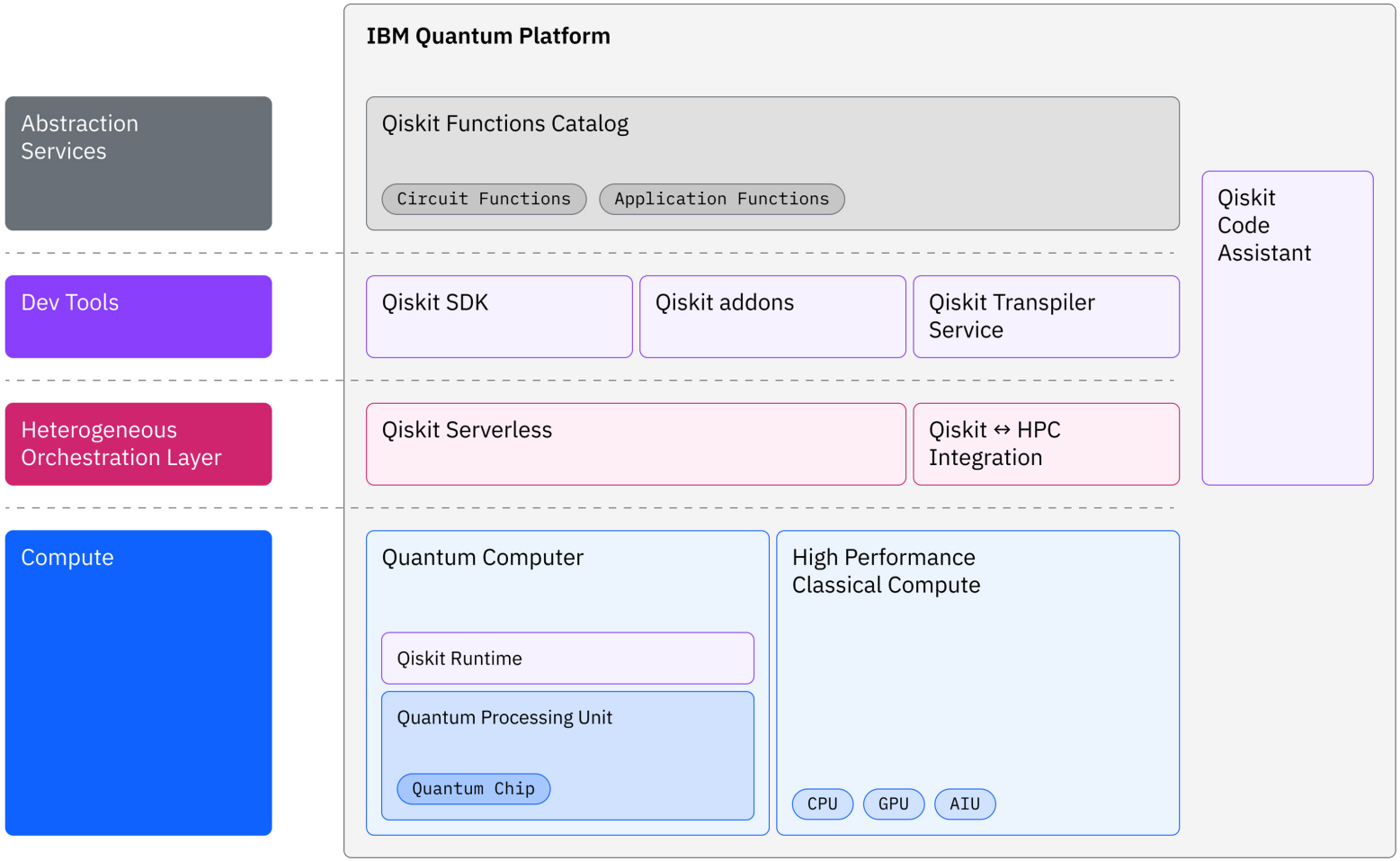
IBM QPUs



Utility Scale Work

Quantum must be performant

Quantum must be easy-to-use


IBM Quantum Platform
Abstraction Services
Qiskit Functions Catalog
Circuit Functions
Application Functions
Qiskit Code Assistant
Dev Tools
Qiskit SDK
Qiskit addons
Qiskit Transpiler Service
Heterogeneous Orchestration Layer
Qiskit Serverless
Qiskit ↔ HPC Integration
Compute
Quantum Computer
Qiskit Runtime
Quantum Processing Unit
Quantum Chip
High Performance Classical Compute
CPU
GPU
AIU

Qiskit SDK

It’s simple…

If it needs a circuit, it needs Qiskit

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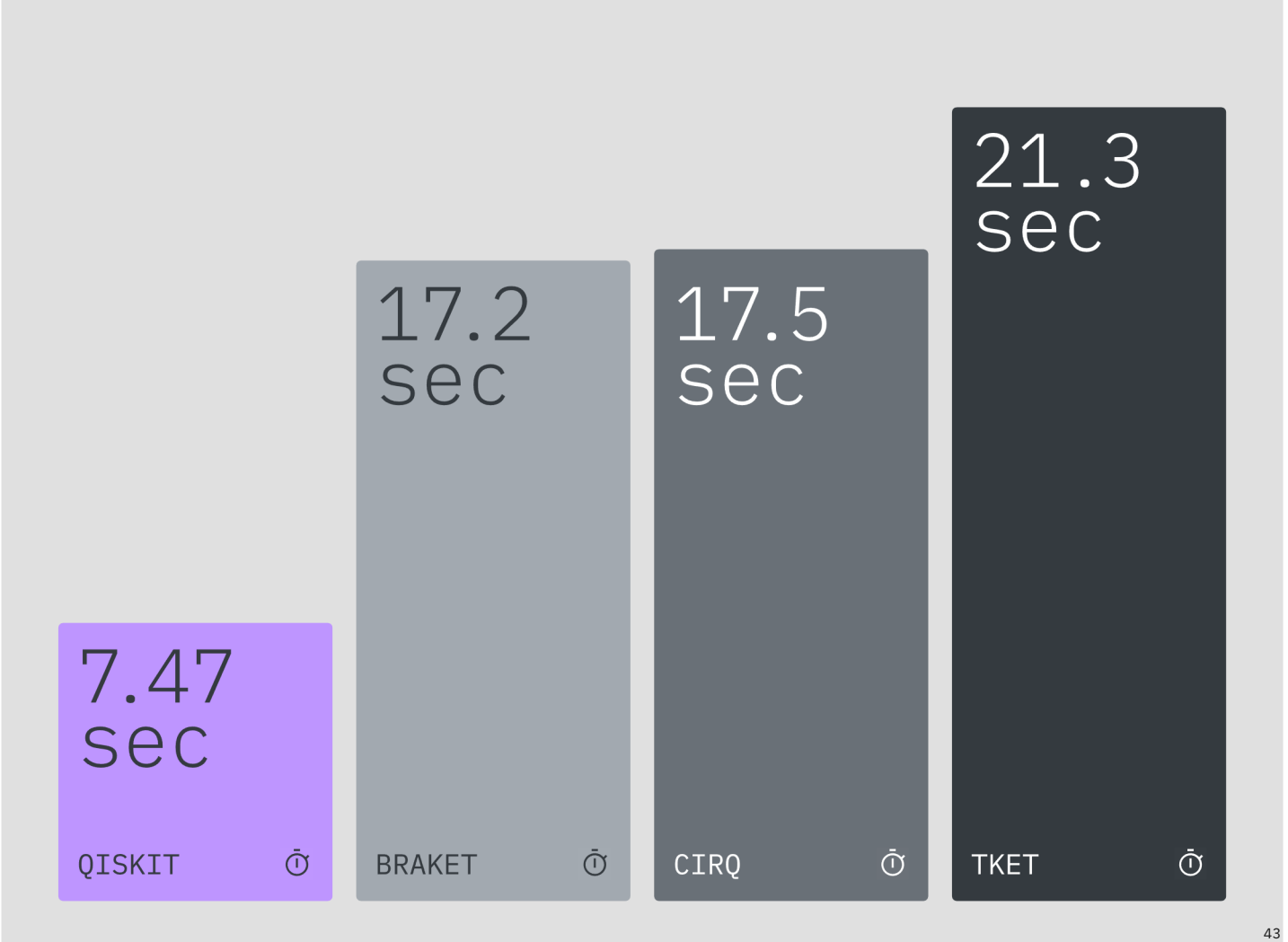
Qiskit SDK

arXiv:2405.08810

The lingua franca of quantum computing;
write once and execute quantum circuits on
10+ different hardware providers

- IBM Quantum
- AQT
- IQM
- Azure Quantum
- Alice & Bob
- IonQ
- Amazon Braket
- Superstaq
- Quantinuum
- Rigetti

Speed: Build & Manipulate Time to Complete



Not included due to insufficient test results: CUDA & Staq

*Timing measured using only completed tests

Data based on arXiv:2409.08844 paper published 2024.SEP.13

IBM Quantum | © 2025 IBM Corporation

Qiskit Pattern:
The anatomy of a quantum algorithm

01
Map problem instance to quantum circuits and operators

Map

02
Optimize for target hardware execution

Optimize

03
Execute via Qiskit Runtime

Execute

04
Result processing

Post-Process

Qiskit SDK sets the foundation

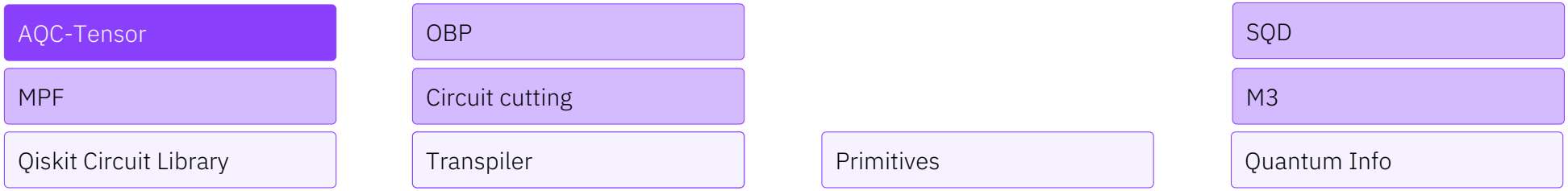
Qiskit SDK gives us a base layer of building blocks for building and running quantum algorithms

Qiskit Circuit Library	Transpiler	Primitives	Quantum Info
Input: Domain inputs	Input: Circuits, observable	Input: ISA circuit, observable	Input: Expectation value/samples
Output: Circuits, observable	Output: ISA circuit, observable	Output: Expectation value/samples	Output: Data objects/visualizations
Map	Optimize	Execute	Post-Process

Qiskit addons build on the Qiskit SDK

A collection of research capabilities developed as modular tools that can plug into a workflow to design new algorithms at the utility scale

Starting with multi-product formulas (MPF), approximate quantum compilation (AQC-Tensor), operator backpropagation (OBP), and sample-based quantum diagonalization (SQD).



Input:
Domain inputs

Output:
Circuits, observable

Map

Input:
Circuits, observable

Output:
ISA circuit, observable

Optimize

Input:
ISA circuit, observable

Output:
Expectation value/samples

Execute

Input:
Expectation value/samples

Output:
Data objects/visualizations

Post-Process

Our formula for bringing useful quantum computing

Hardware

Maintaining the industry's largest and most performant fleet of **utility-scale quantum computers** on the cloud for our clients and the quantum community to experiment with.

Software

Developing Qiskit, the world’s most popular open source quantum toolkit that makes quantum computing easy to learn and use by bringing resources together in one place.

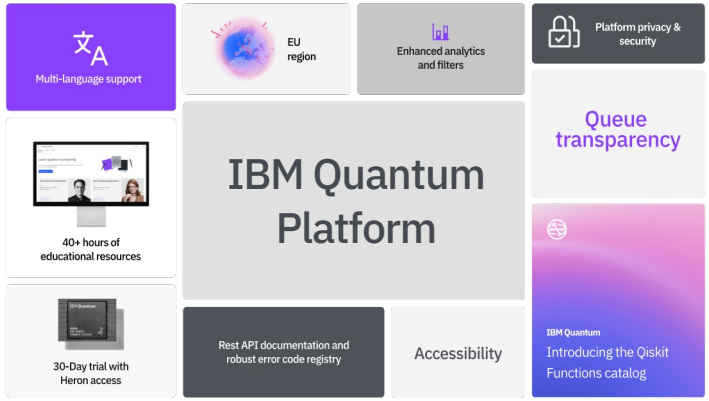
Ecosystem

Nurturing a **community of 300+ clients and partners,** all working to solve real scientific and business problems with quantum computing.

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A PLATFORM
for quantum computing

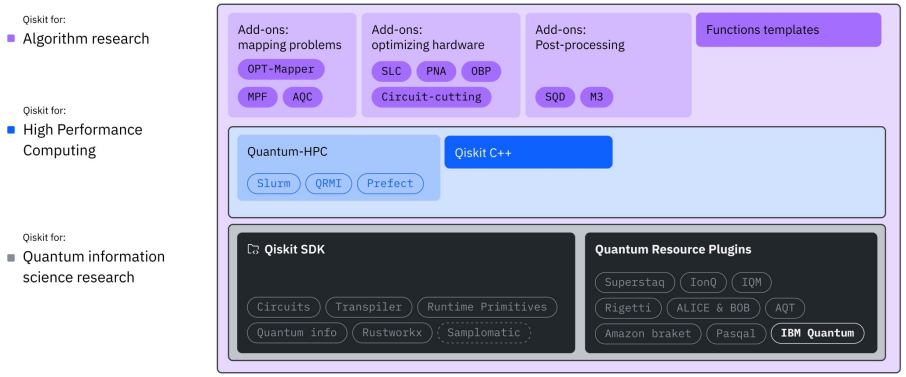
IBM Quantum Platform



A cloud platform that allows us to deliver the most performant 100Q+ quantum computers for global distribution

A set of runtime and application services that enable you to unlock advantage on today's systems

Qiskit



An open SDK that provides flexible and comprehensive interfaces for building, optimizing, and executing quantum circuits at scale

A collection of open science tools for designing QCSC and developing novel algorithms

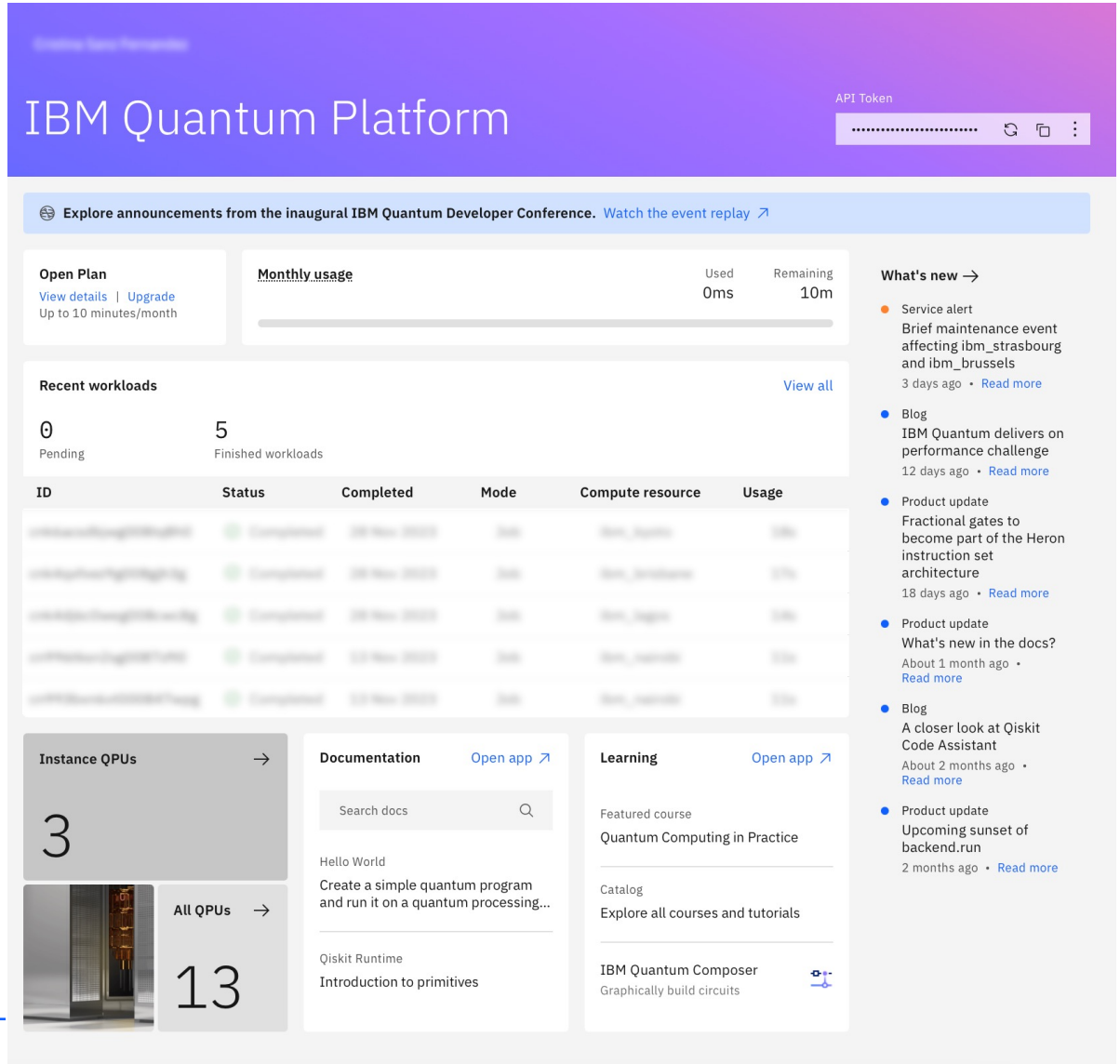
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IBM Quantum Platform

To bring useful quantum computing to the world, quantum computing must be easy to use.

To support this mission, we've gathered all IBM Quantum resources into one easy-to-access location.

Our goal is to build a mature and stable quantum programming experience.



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quantum.ibm.com

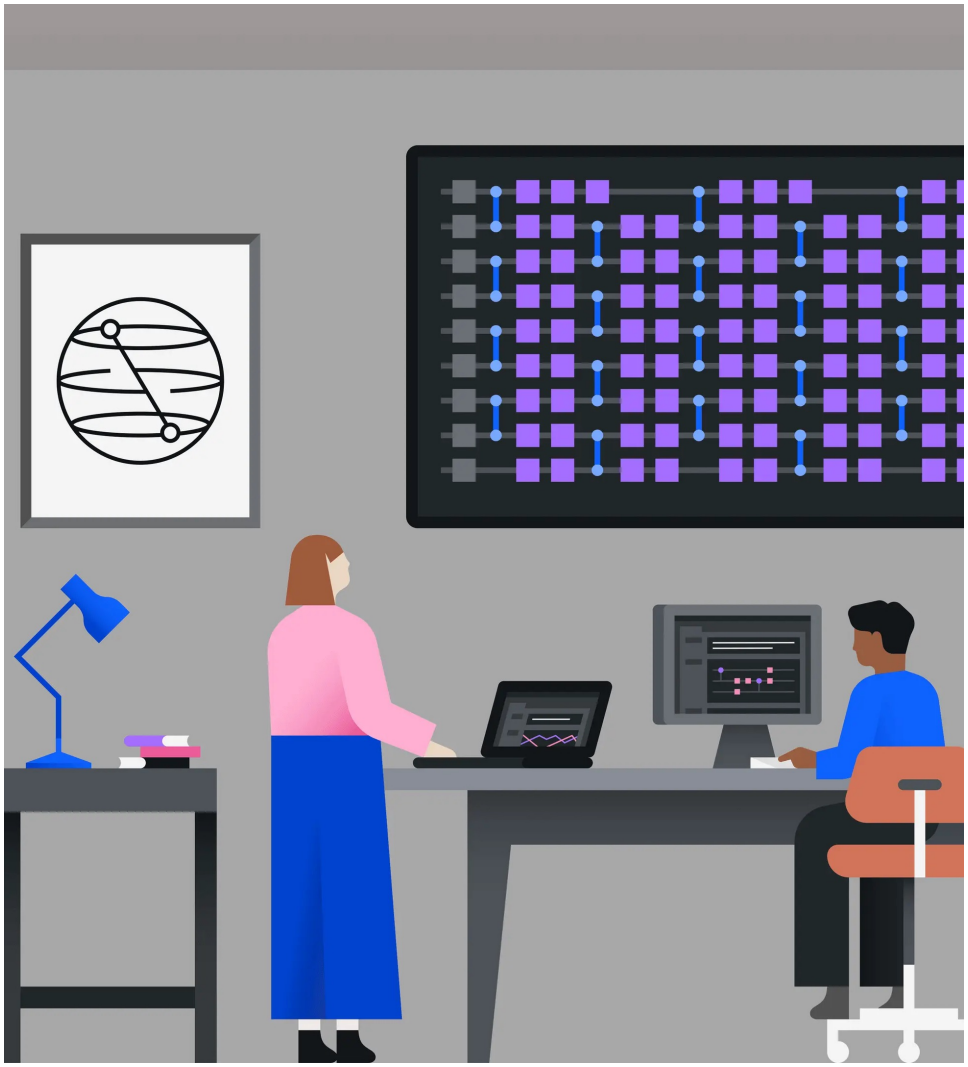
Begin exploring quantum today with the Open Plan

Get up to 10 minutes of runtime per month free.

✓ Access to IBM Quantum Compute service
✓ Access to 100+ qubit quantum computers

Create an account on IBM Quantum Platform and start using 100+ qubit IBM quantum computers today!

PROMO: get 180 minutes IBM QPU runtime free when you use at least 20 minutes over a 12-month period.



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IBM Quantum Learning

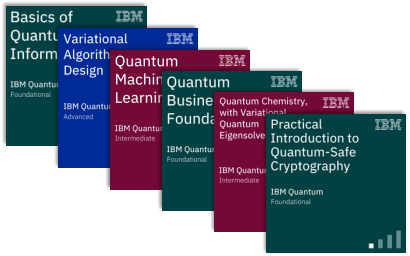
Interactive courses, tutorials, and tools to help you build a foundation in quantum.

Experiment with the latest IBM Quantum hardware and software technology.

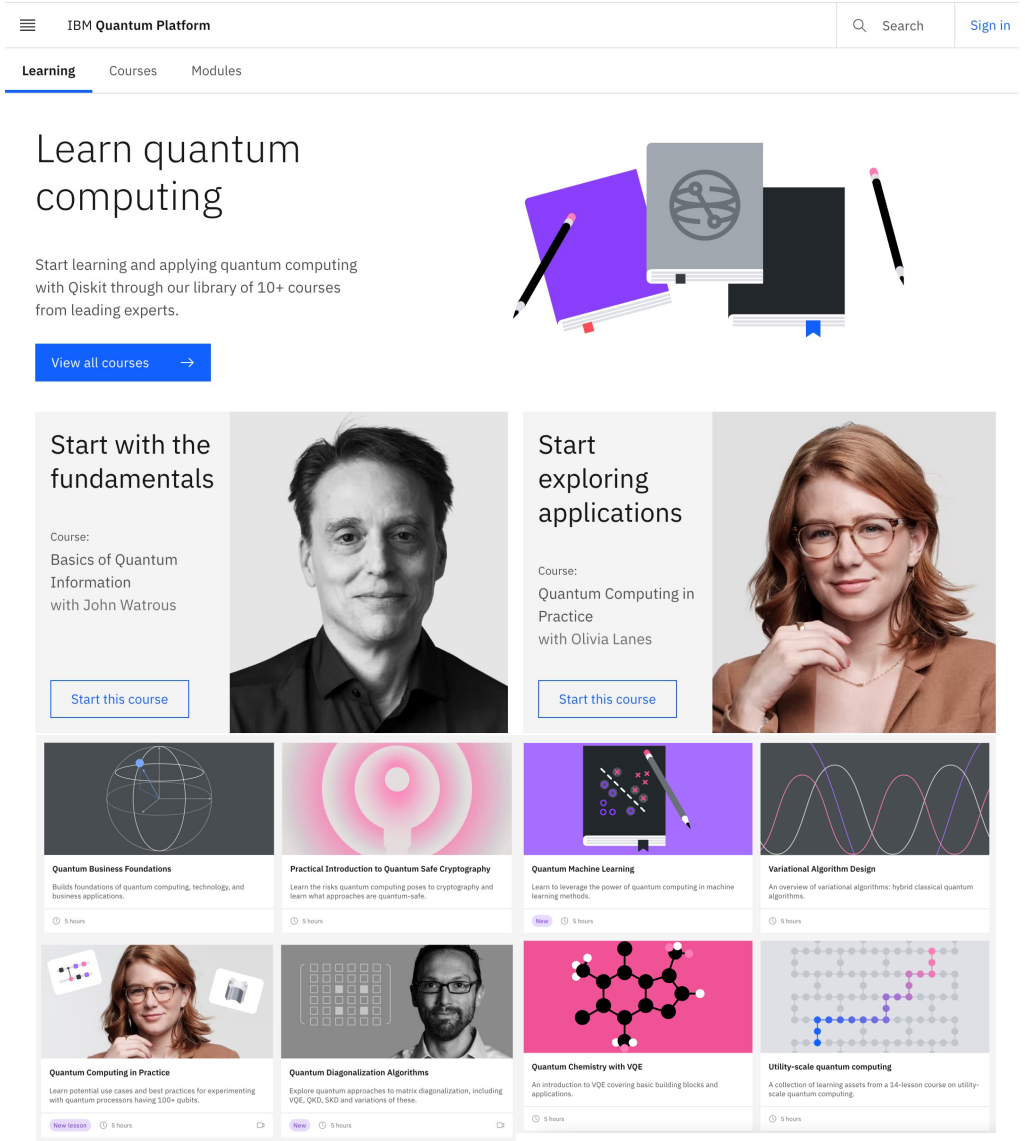
Access to (1) courses, (2) tutorials, (3) badges and other learning resources

Course topics include:

- Basics of quantum information
- Fundamentals of quantum algorithms
- Practical introduction to quantum-safe cryptography
- Variational algorithm design



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Qiskit

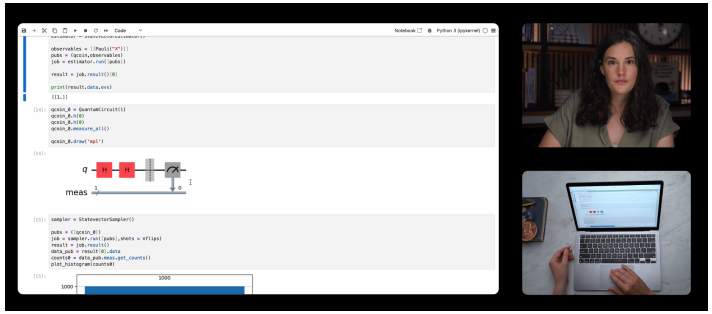
In the Classroom

Get the future quantum workforce using real quantum computers early by introducing modules into classrooms and integrating them into quantum-adjacent course syllabi.

About the modules:

- Target audience: future quantum practitioners
- ~1-hour-long, Jupyter notebooks on key concepts from a quantum computing related course
- Text and Qiskit code, check-in questions and coding activities for the learner to check their understanding
- Designed to be easily plugged into courses with minimal effort from the educator
  - Target courses: undergraduate quantum-adjacent STEM courses
- Optional videos paired with each module

YouTube Videos



```
estimator = Estimator(mode = backend)
job = estimator.run([[qc_isa,obs_isa]])
res = job.result()

# Run the job on the Aer simulator with noise model from real backend
#job = estimator_sim.run([[qc_isa,obs_isa]])
#res=job.result()

#Step 4: Return the result in classical form, and analyze.

print(res[0].data.evs)
```

✓ 21.3s Python

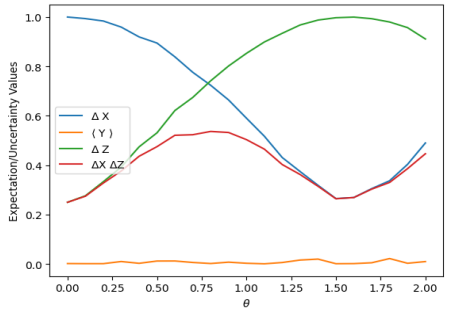
```
-0.02906350914962325
```

According to our equation above,

$$(\Delta X)^2 = 1 - \langle X \rangle^2 = 1 - (0.0107)^2 \rightarrow \Delta X = 0.999...$$

Let's stick with that same state, but find the expectation value of Z, now:

Uncertainty relations

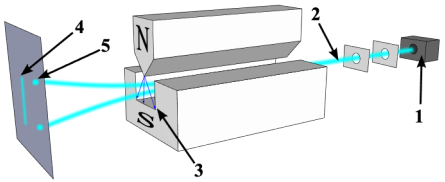


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Modules for Intro Quantum Mechanics

Stern-Gerlach Experiment – a module on spin quantization

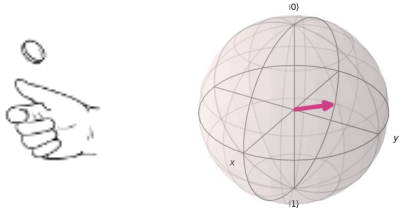
Module 01



- Uses real qubits to reproduce original Stern-Gerlach results and extensions

Quantum Coins – a module on superposition and interference

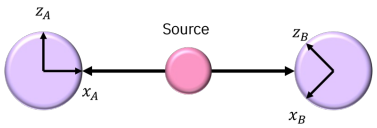
Module 02



- Compares measurement of a qubit in equal superposition to a coin flip and explores limits of that analogy.

Bell's Inequality – a module on entanglement and disproving local realism

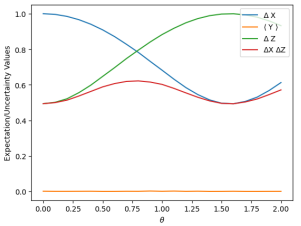
Module 03



- Shows how quantum mechanics violates Bell's inequality using a real quantum computer.

Quantum Uncertainty – a module on uncertainty relations

Module 04



- Checks the generalized uncertainty relations of Pauli observables with a qubit

IBM

Modules for Computer Science

Quantum Teleportation

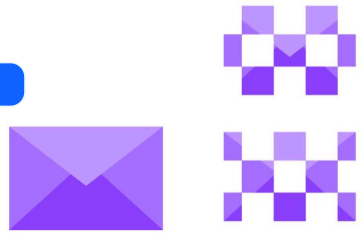
Module 05



- Walks through the quantum teleportation protocol, then shows how to implement it on an IBM quantum computer.

Quantum Key Distribution and BB84

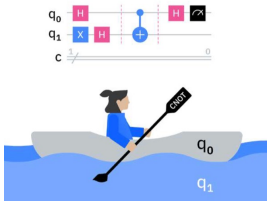
Module 06



- After a primer on cryptography, shows students how the BB84 protocol protects against unnoticed eavesdroppers.

Deutsch and Deutsch-Jozsa algorithms

Module 07



- Shows how the D and D-J algorithms work, with discussions of quantum parallelism and phase-kickback
- Applies the D-J algorithm to the Bernstein-Vazirani problem

Grover's Algorithm

Module 08 New

Quantum Fourier Transform

Module 09 New

Variational Quantum Eigensolver

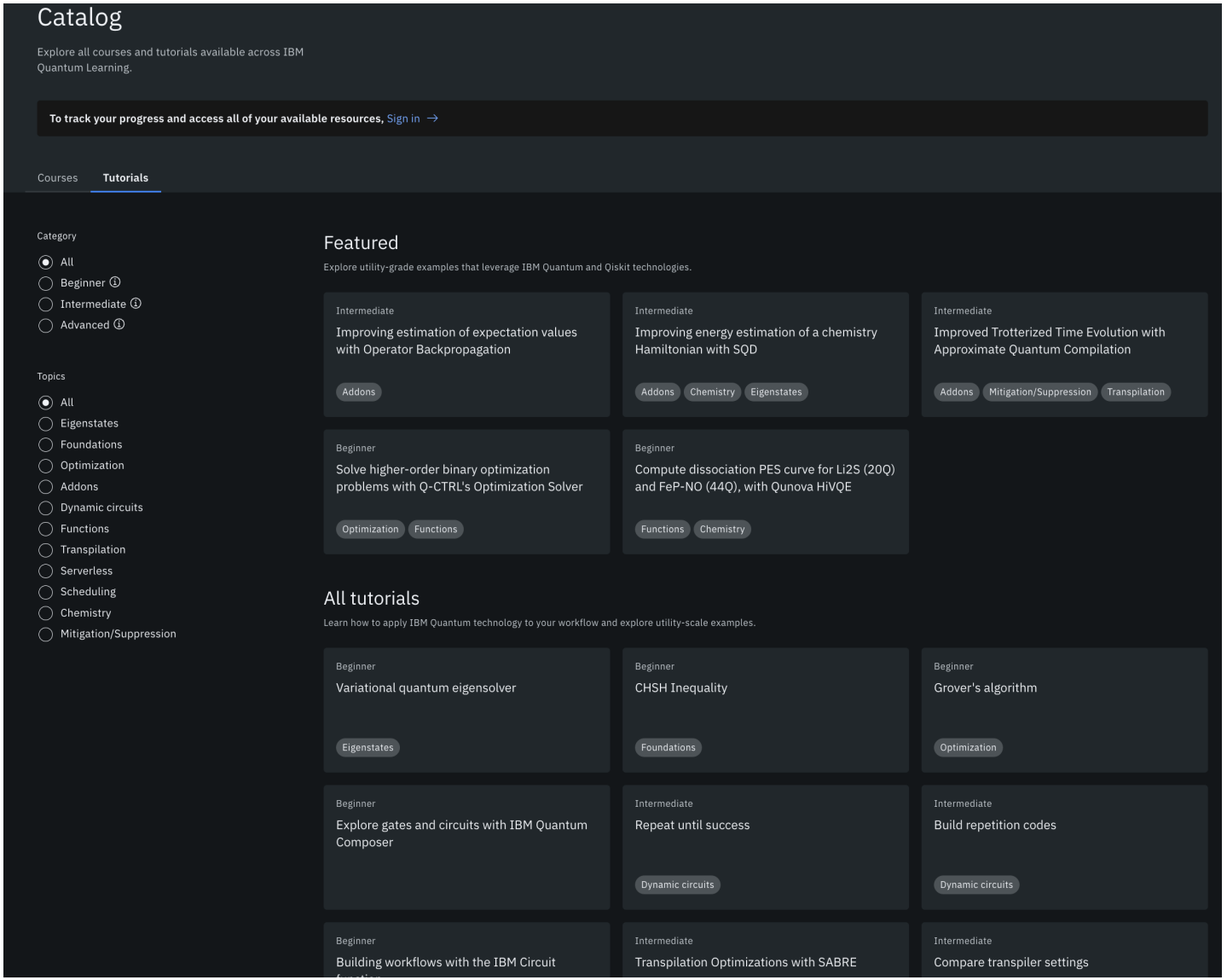
Module 10 New

IBM

IBM Quantum Learning

Tutorials

Explore utility-grade algorithms and applications with Qiskit Runtime



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Qiskit Youtube

Engaging lectures, tips & tricks, tutorials, community updates and access to exclusive Qiskit content.

Notable Playlists:

Qiskit in the Classroom

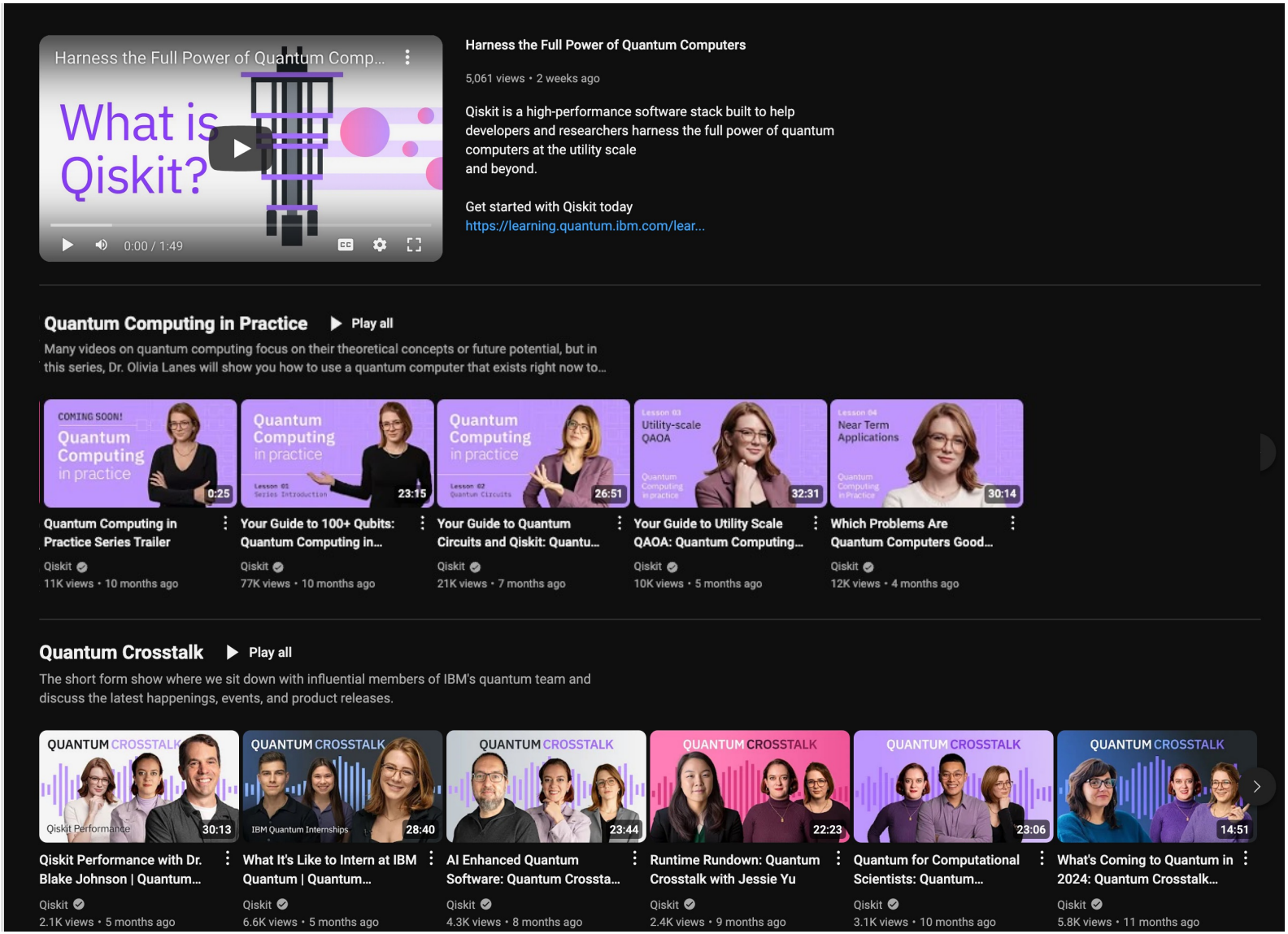
Quantum Computing in Practice

Quantum Crosstalk

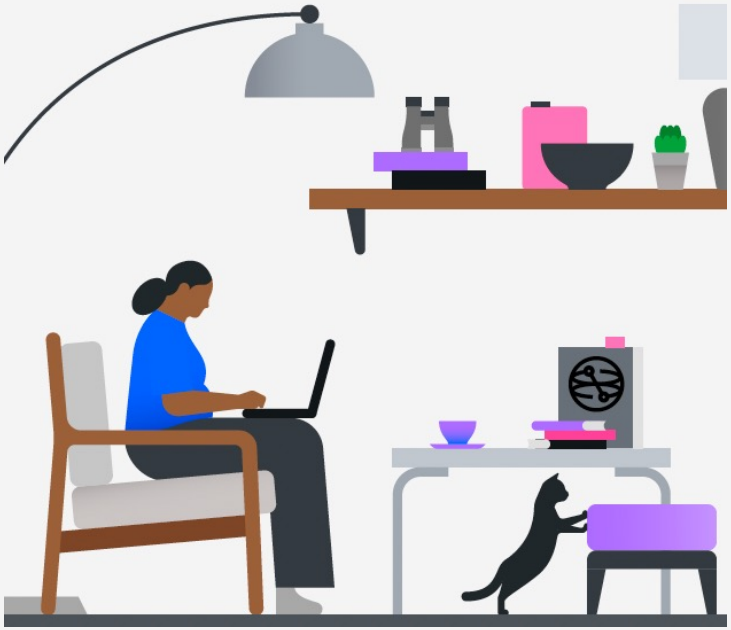
Qiskit Quantum Seminars

Coding with Qiskit 1.x

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IBM Certified Quantum Computation using Qiskit v2.X Developer



1500+

Developers with Qiskit certification

71

Countries with Qiskit-certified developers

The new and updated Qiskit certification is available on IBM Training now!

Validate your Qiskit 2.X skills, with topics such as performing quantum operations, creating quantum circuits, as well as running quantum circuits.

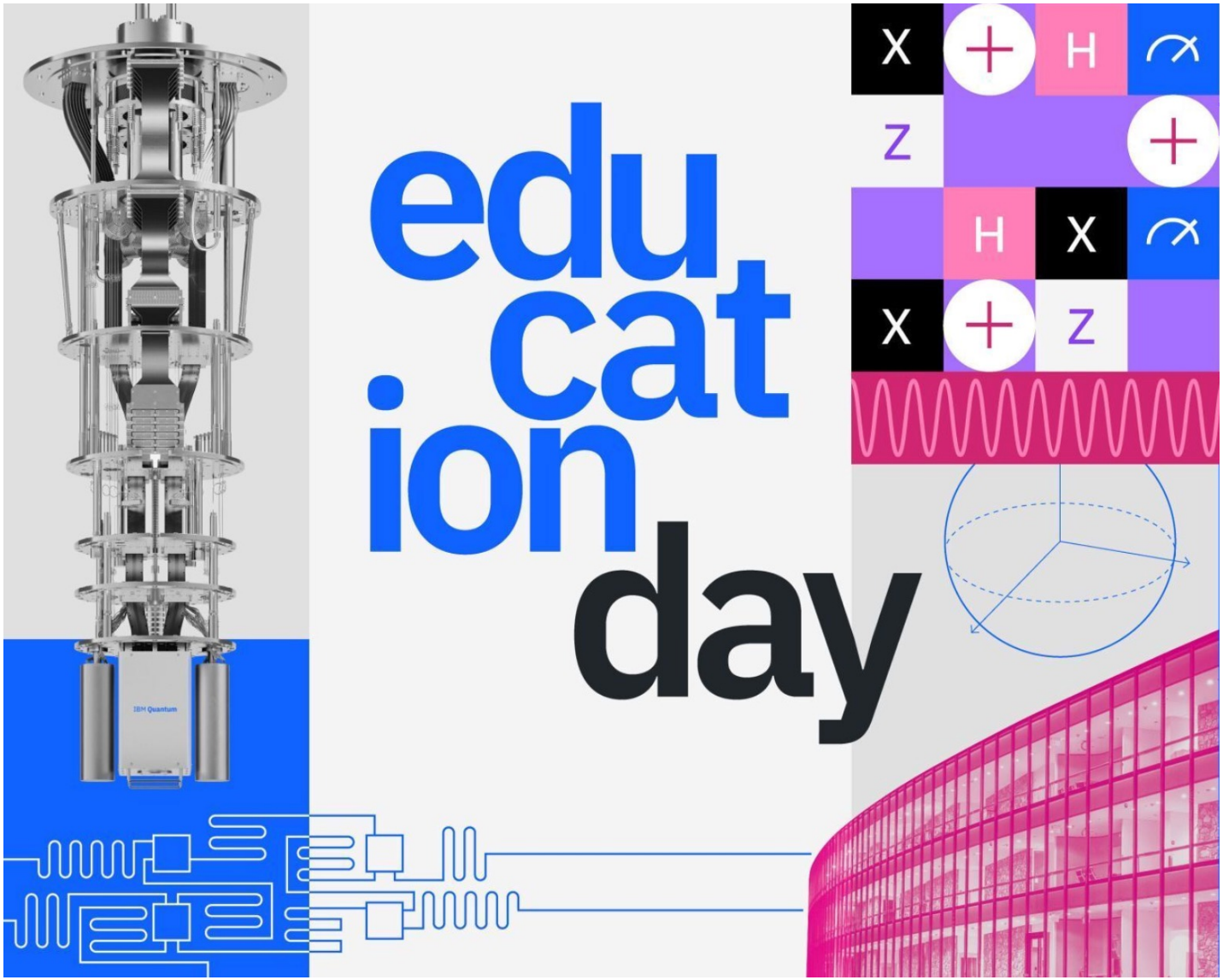
A free study guide and sample test are available through IBM Training.





www.ibm.biz/qiskit-cert

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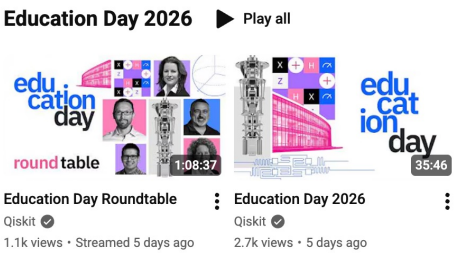


In this event, you'll hear from professors and education leaders about:

- Teaching quantum computing at different skill levels
- Building accessible quantum curriculum
- Real-world classroom experiences
- Hands-on learning with Qiskit and IBM Quantum
- The future of quantum education

Available now on the Qiskit YouTube channel!

youtube.com/@qiskit



IBM Quantum community

IBM Quantum Learning

An online platform for learning the basics of quantum computing, and how to use IBM Quantum services and systems to solve real-world problems.

Qiskit Advocates

A global program that provides support to individuals who actively contribute to the Qiskit community. There are hundreds of Qiskit advocates representing many countries who contribute to the Qiskit community.

Qiskit Global Summer School

An annual event featuring online lectures delivered by various IBM Quantum experts, as well as live Q&A sessions.

Qiskit YouTube channel

The Qiskit YouTube channel hosts hundreds of useful videos on quantum computing.

Qiskit Developer Certification

The world's first ever developer certification for programming a quantum computer, setting the benchmark for quantum developer skills.

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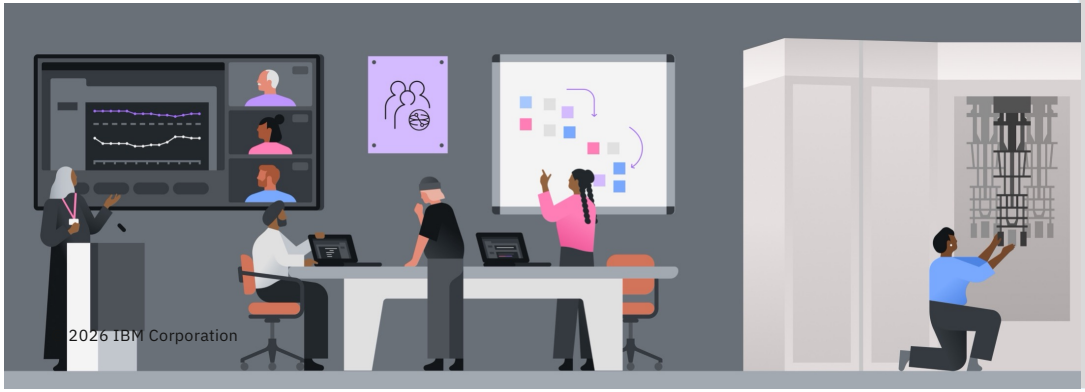
What do Qiskit advocates do?

Activities:

- Give talks and presentations on Qiskit at events and conferences
- Contribute to the Qiskit SDK and Qiskit Ecosystem projects
- Mentor participants in flagship events and host events in your local community
- Provide feedback on Qiskit and IBM Quantum tools as active users
- Collaborate with advocates globally
- Earn points through community contributions to advance through program tiers



For more information, see:
ibm.com/quantum/qiskit#advocates



Ready to get started?

Applications are now open:

ibm.biz/advocates-application

Eligibility:

- Open to quantum enthusiasts worldwide*
- Complete any of the following qualifications:
  - Basics of Quantum Information badge OR
  - Fundamentals of Quantum Algorithms badge OR
  - QGSS 2025 Quantum Excellence (advanced) badge OR
  - Qiskit v2.X Certification

If you are an existing advocate:

- Find an invitation to the new program in your email (sent 7 May 2025)
- OR if you have not received this email, get back in contact via **ibm.biz/lost-contact-advocates**

* Applicants must also be at least 18 years of age and not usually residing in any of the unavailable countries as listed at quantum.ibm.com/terms

IBM **Quantum**