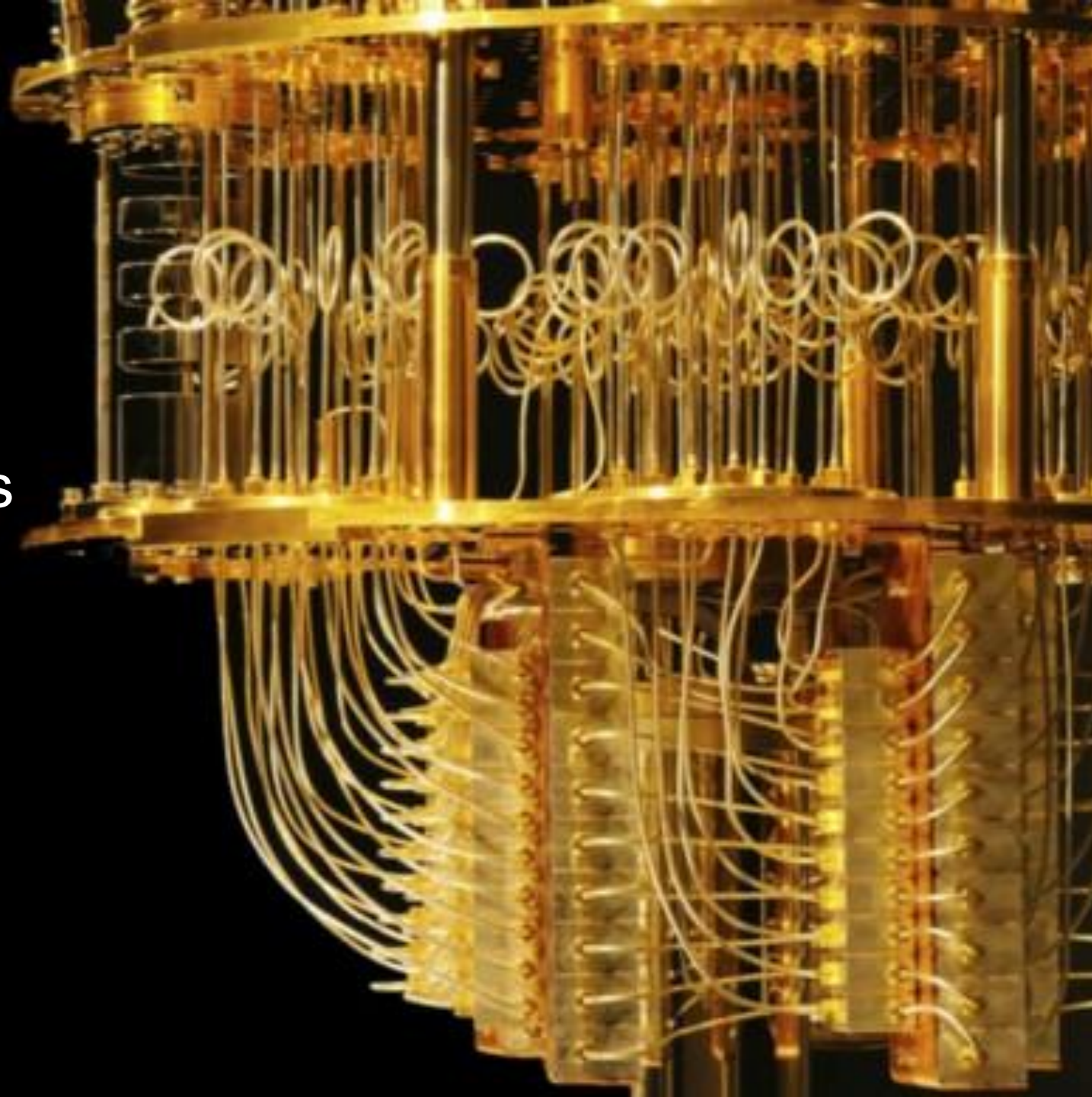




qBraid

Explore Quantum Computing

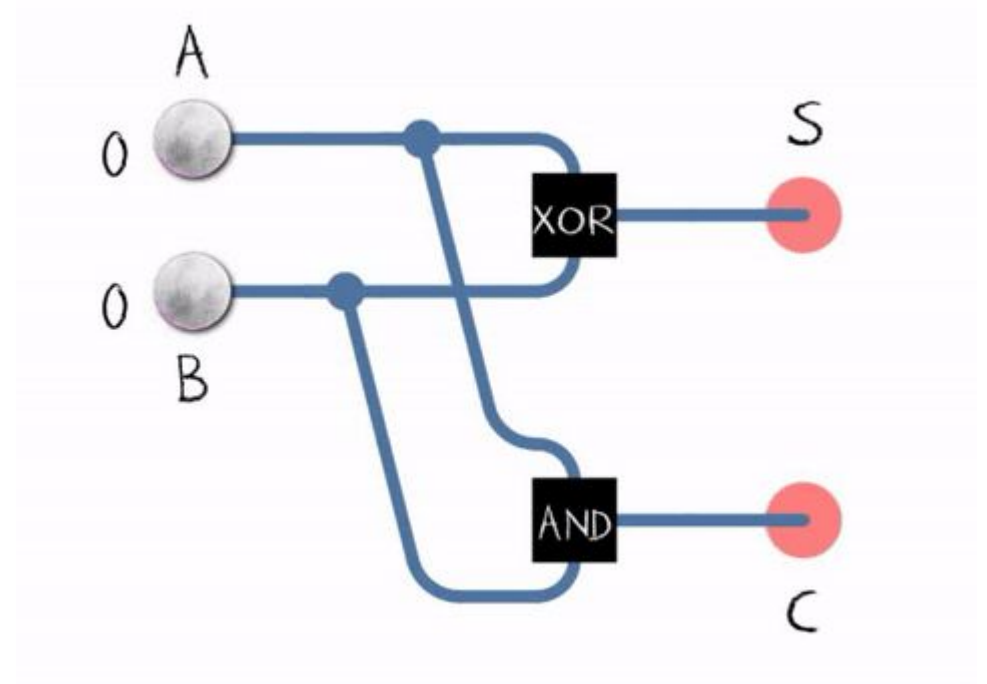
Quantum computing uses the properties of quantum (subatomic) particles such as superposition and entanglement to perform computation.



How does a digital computer work?

	Classical computers
Data format	  Either 1 or 0
Sample representation	8 bits - 01100001 Letter "A"
Time to hack the internet	300 trillion years

Basic classical sum



2 transistors can add up to 2 bits

How do classical computers work?



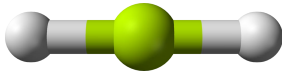
Where are we?



iPhone 12

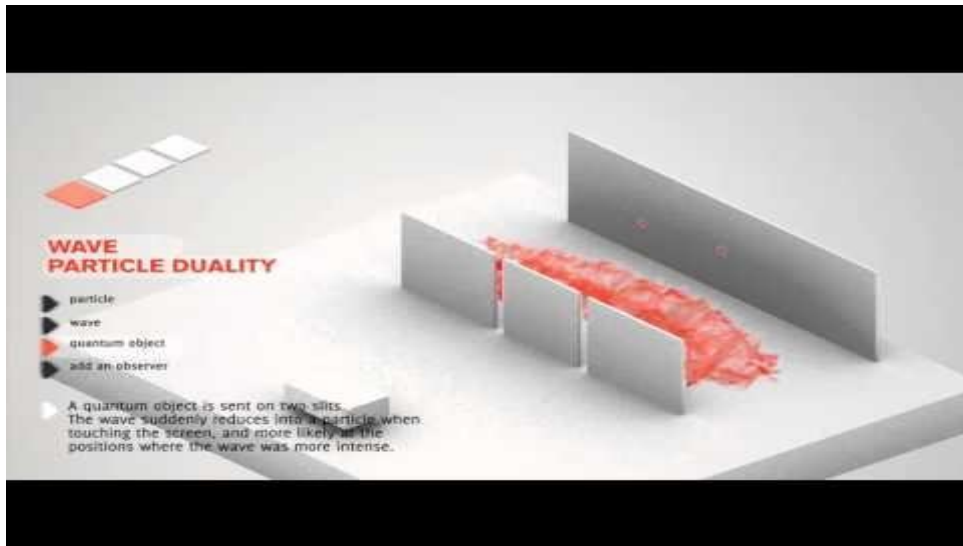
- 11.8 B transistors
- 32 B bits (memory)
- Plays Among Us

How do quantum computers work?

	Classical computers	Quantum computers
Data format	 Either 1 or 0	 1 or 0 at the same time
Sample representation	8 bits - 01100001 Letter "A"	3 qubits- $\frac{ 000\rangle + 111\rangle}{\sqrt{2}}$  7 qubits Beryllium hydride
Time to hack the internet	300 trillion years	8 hours

How do quantum computers work?

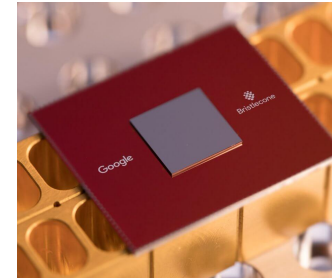
Quantum properties



Where are we?

Google Sycamore

- 72 qubits
- Operates at -460F
- Simulations of '40s computer



Where does qBraid come in?

Develop for top quantum computing hardware and platforms

The screenshot shows the qBraid web interface with a navigation bar at the top containing a logo, 'Home', 'Token', the email 'qbraid@qbraid.com', and a 'Logout' button. The main heading is 'Launch an environment'. Below this, five environment cards are displayed:

- Qiskit Textbook** (IBM logo): Includes tags for qiskit, textbook, hardware, machine learning, and quantum chemistry. Description: 'This is an environment optimized for accessing qiskit-textbook. All the code and widgets available in qiskit-textbook work out of the box in this environment. This environment can be used to play with the code snippets available in qiskit textbook, and also to develop using qiskit libraries.' Resources: 110 packages, 2 vCPU • 1GB RAM. Buttons: Customize, Launch.
- AWS Braket** (AWS logo): Includes tags for AWS, hardware, simulator, machine learning, and quantum chemistry. Description: 'AWS Braket is a quantum computing ecosystem by Amazon. It comes with a simulator as well as access to Hardware from D-Wave, Ion-Q, and Rigetti. Use this platform to develop quantum computing applications using AWS libraries and various hardware.' Resources: 18 packages, 2 vCPU • 1GB RAM. Buttons: Customize, Launch.
- Xanadu** (Xanadu logo): Includes tags for xanadu, simulator, and machine learning. Description: 'This is a quantum computing environment for developing applications using Xanadu's libraries, including pennylane and strawberryfields. PennyLane can be used for developing machine learning applications and strawberryfield applications provide API access to Xanadu's photonic quantum computer. Hardware access may not be available through qBraid.' Resources: 99 packages, 2 vCPU • 1GB RAM. Buttons: Customize, Launch.
- Cirq & OpenFermion** (Google logo): Includes tags for google, hardware, compiler, quantum chemistry, and quantum algo. Description: 'This environment is optimized for using Google's quantum computing libraries. Currently, Google has made only OpenFermion available, which is a Python library for doing quantum chemistry on quantum computers.' Resources: 37 packages, 2 vCPU • 1GB RAM. Buttons: Customize, Launch.
- pyQuil** (Rigetti logo): Includes tags for rigetti, hardware, compiler, quantum chemistry, and quantum algo. Description: 'This environment is optimized for using Rigetti's quantum computing libraries.' Resources: 86 packages, 2 vCPU • 1GB RAM. Buttons: Customize, Launch.



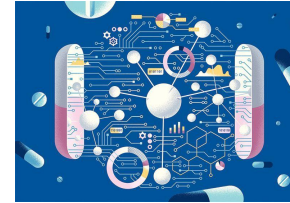
Why is this relevant?

Applications of quantum computing



Transportation

Optimization of
Traffic routes



Drug discovery

Simulation of new
drugs



Cryptography

Breaking RSA encryption
and post-quantum
cryptography



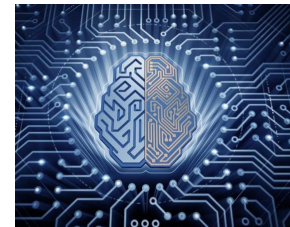
Financial modeling

Optimal pricing of derivatives



Material research

Predicting properties of complex
material



Quantum AI

Improving AI beyond classical
computing limits

What some of the **companies** are **involved**?



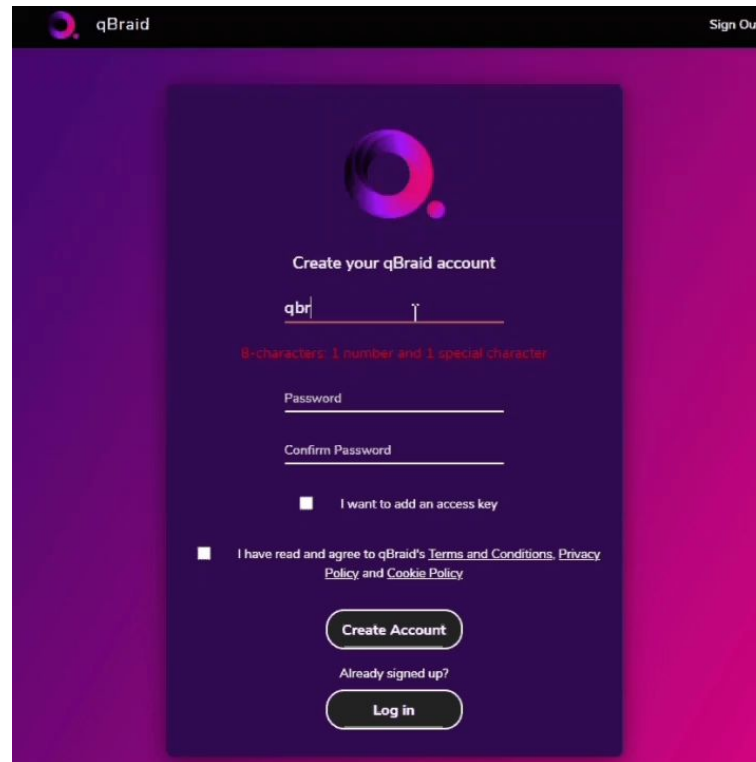
And many more
are **getting**
involved every
year

JPMORGAN CHASE & CO.

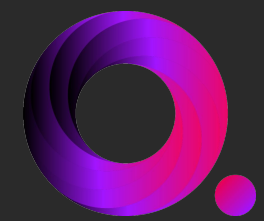


Sign up for qBraid

Go to: <https://account.qbraid.com/join>



The screenshot shows the qBraid account creation interface. At the top, there is a header with the qBraid logo and a 'Sign Out' link. The main content area has a dark blue background with a central white box containing the qBraid logo and the text 'Create your qBraid account'. Below this, there are input fields for 'Username' (containing 'qbr'), 'Password', and 'Confirm Password'. A red error message is visible below the username field: '8 characters: 1 number and 1 special character'. There are two checkboxes: 'I want to add an access key' (unchecked) and 'I have read and agree to qBraid's Terms and Conditions, Privacy Policy and Cookie Policy' (checked). At the bottom of the white box, there are two buttons: 'Create Account' and 'Log in'. Below the 'Log in' button, there is a link 'Already signed up?'.



Aloha, Quantum World!

Hello, World!

- Developed by Brian Kernighan, in 1974.
- the simplest possible program for the language
- a demonstration of the syntax for a particular language
- and to check everything is working correctly.

Quantum version

- Similar to 'Hello, World!' we would want it to be the simplest quantum program.
- 'Aloha, World!' should ensure the faithfulness of the quantum stack (hardware and software).
- Then, we want to go one step further. If you look into the details of 'Aloha, World!', it should present to you the details for how quantum computing is fundamentally different than classical computing.