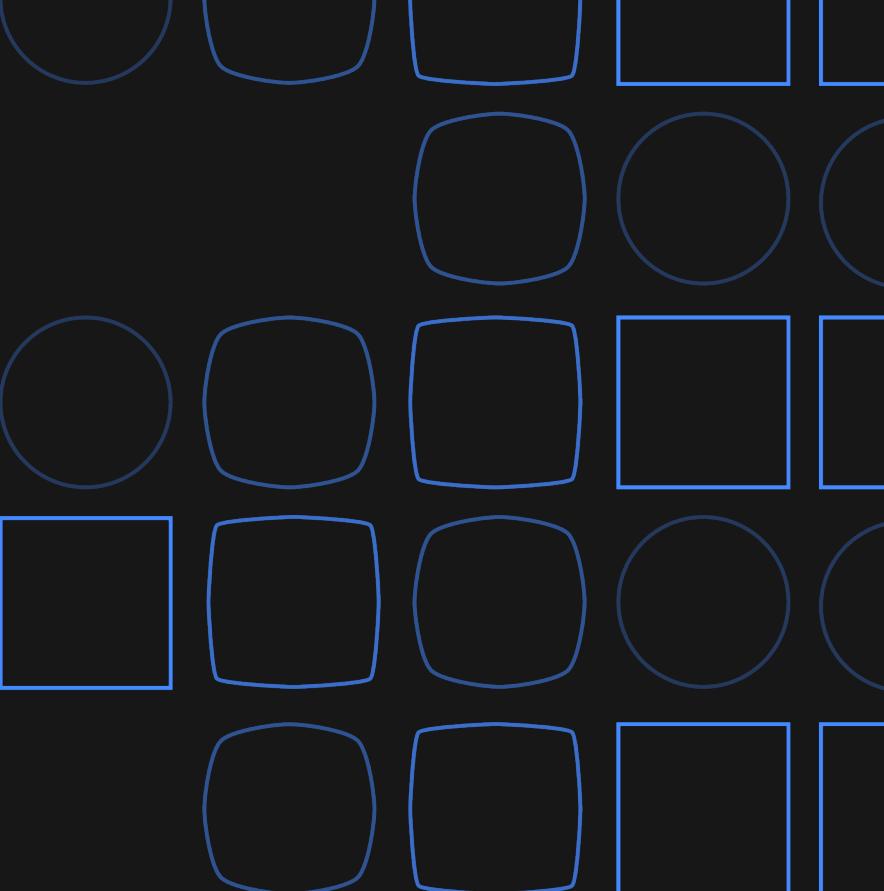


# Qiskit workshop for PC5228

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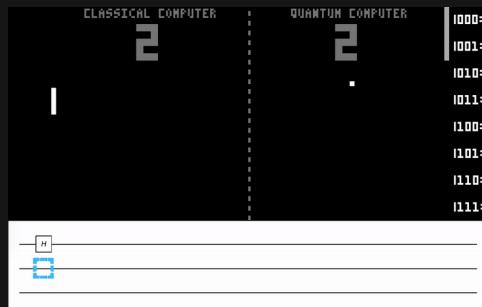
Junye Huang

Quantum Developer Advocate



# About me

- Quantum developer advocate focusing on [quantum education](#)
- PhD candidate in experimental low temperature physics at NUS
- Participant of [the first Qiskit Camp](#)
- Organized [the first university Qiskit hackathon](#) in the world
- Co-creator of quantum games: [QPong](#), [QPong Arcade](#), [QiskitBlocks](#), ...



# Schedule

Date	Start	End	Subject
21 Aug	12:00	13:30	Introduction to Qiskit and IBM Quantum Experience
18 Sep	12:00	14:00	Quantum algorithms: Deutsch-Josza and Grover algorithm
6 Nov	12:00	14:00	Quantum applications: Simulating Molecules using Variational Quantum Eigensolver (VQE)

All sessions will be recorded

# Session 1: Introduction to Qiskit and IBM Quantum Experience

Start	End	Duration	Subject
12:00	12:10	0:10	Opening and Overview
12:10	12:40	0:30	IBM Quantum Experience <ul style="list-style-type: none"><li>• Overview</li><li>• Circuit composer</li><li>• Hardware backends</li></ul>
12:40	12:45	0:05	Break
12:45	13:15	0:30	Qiskit   Quantum Information Science Kit <ul style="list-style-type: none"><li>• Overview</li><li>• Qiskit tutorials</li><li>• Qiskit textbook</li></ul>
13:15	13:30	0:15	Qiskit Community



**IBM Quantum Experience**  
is the quantum cloud services and  
software platform designed to  
take full advantage of IBM Q  
systems.

# IBM Quantum Experience

Quantum circuits

200 B+

Users

250 k+

Client partners

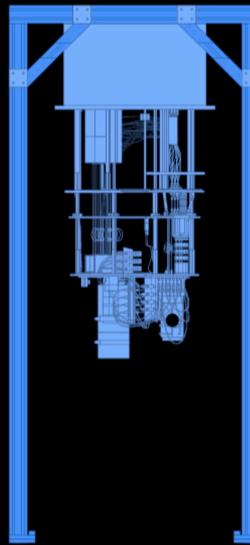
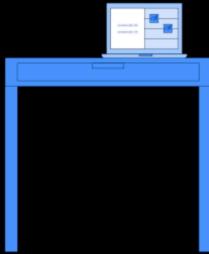
115+

Research papers

250+

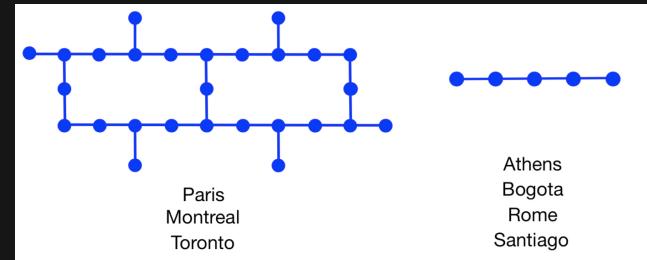
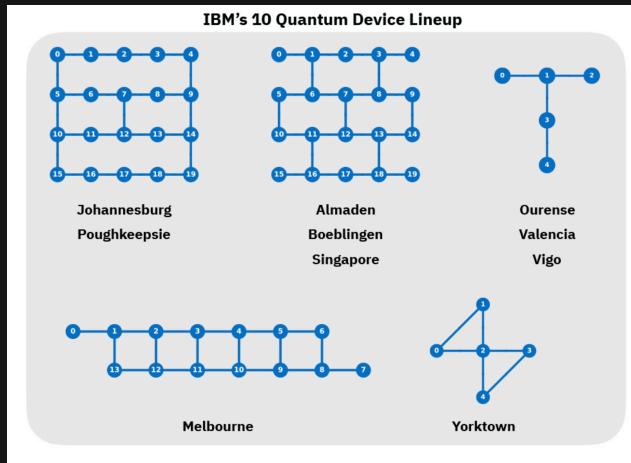
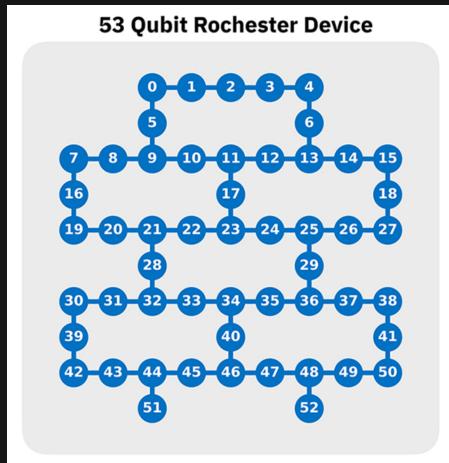
Quantum systems

22+



IBM Q

# IBM Quantum Systems



Open access: 10 systems

Premium access: 22+ systems

# Qiskit software stack



Qiskit



Hardware

Tools for  
characterizing and  
mitigating error



Ignis

Framework and libraries of quantum  
algorithms that allows users to leverage  
quantum computing efficiently



Aqua

Special purpose  
simulators for  
algorithm  
development and  
quantum research



Aer

Foundational tools to  
build, run and compile  
quantum circuits

# What can you do with Qiskit?

Originally QISKit: Quantum Information Science Kit

- Compose quantum programs at the level of circuits and pulses
- Circuit transpilation
- Execute quantum programs using simulators and real devices
- Study noise models
- Perform benchmarking tests (T1, T2 measurement, Randomized Benchmarking, Quantum Volume)
- Run quantum algorithms (Deutsch-Jozsa, VQE, Grover)
- Study quantum applications (optimization, finance, chemistry, QML)

Ref: [Qiskit Documentation](#)

# Open source

**qiskit-terra**  
Terra provides the foundations for Qiskit. It allows the user to write quantum circuits easily, and takes care of the constraints of real hardware.

SDK · quantum · quantum-computing · quantum-circuit · quantum-programming-language · qiskit · ibmq

Python · Apache-2.0 · 1,192 · 2,831 · 301 (3 issues need help) · 125 · Updated 1 minute ago

**qiskit-aqua**  
Quantum Algorithms & Applications in Python

algorithm · quantum-computing · qiskit-aqua

Python · Apache-2.0 · 298 · 395 · 55 (4 issues need help) · 24 · Updated 21 minutes ago

**networkx**  
A python graph library implemented in Rust.

python · rust · graph · graph-theory · dag

Rust · Apache-2.0 · 8 · 17 · 8 · 10 · Updated 6 hours ago

**qiskit**  
Qiskit is an open-source framework for working with noisy quantum computers at the level of pulses, circuits, and algorithms.

documentation · quantum-computing · quantum-programming-language · qiskit

Python · Apache-2.0 · 450 · 1,180 · 47 · 4 · Updated 14 hours ago

**qiskit-ignis**  
Ignis provides tools for quantum hardware verification, noise characterization, and error correction.

Python · Apache-2.0 · 123 · 118 · 37 · 8 · Updated 14 hours ago

**qiskit-aer**  
Aer is a high performance simulator for quantum circuits that includes noise models.

Python · Apache-2.0 · 189 · 159 · 59 (3 issues need help) · 25 · Updated 14 hours ago

**Top languages**

- Python
- Jupyter Notebook
- Rust
- CSS
- OpenQASM

**Most used topics**

- quantum-computing
- qiskit
- quantum-programming-language
- ibmqx

**People** 40 >

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**Qiskit Community**

<https://community.qiskit.org>

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**qiskit-translations**  
Home of Qiskit documentation translations

Shell · 140 · 17 · 21 (8 issues need help) · 20 · Updated 3 hours ago

**qiskit-textbook**  
A university quantum algorithms/computation course supplement based on Qiskit

quantum-mechanics · learn-to-code · quantum-computing · qiskit · quantum-programming

Jupyter Notebook · Apache-2.0 · 266 · 222 · 50 · 20 · Updated 6 hours ago

**MicroQiskit**

Jupyter Notebook · Apache-2.0 · 8 · 12 · 2 · 0 · Updated 10 hours ago

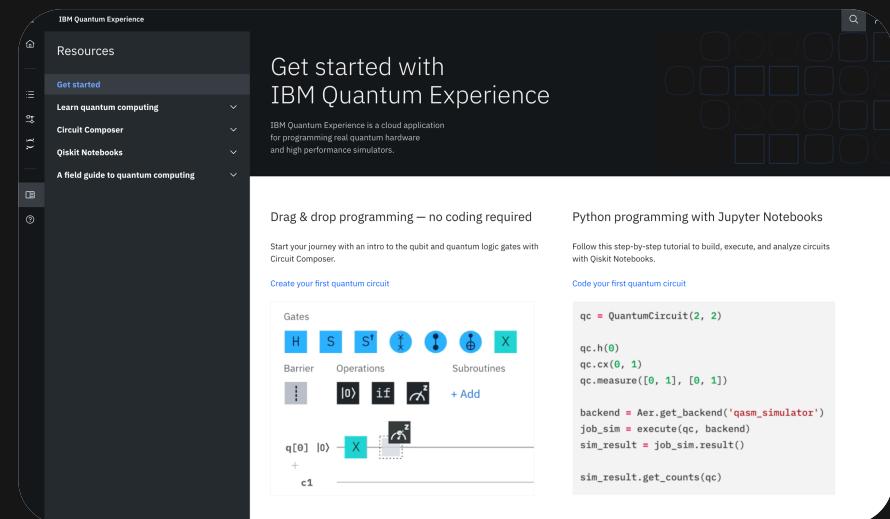
**qiskit-community-tutorials**  
A collection of Jupyter notebooks developed by the community showing how to use Qiskit

Jupyter Notebook · Apache-2.0 · 180 · 199 · 15 · 13 · Updated 9 days ago

200+ contributors inside  
and outside IBM

# Qiskit fundamentals

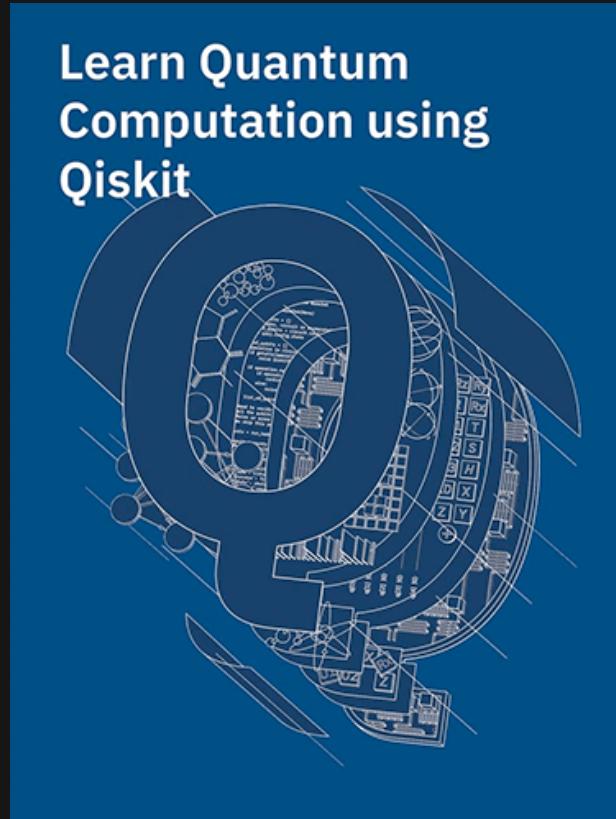
- Install Python and Qiskit [link](#)
- Register IBM Quantum Experience [link](#)
- Run Qiskit code in Jupyter notebook [link](#)
  - On simulators
  - On real devices



Ref: Coding with Qiskit [Ep.2](#) & [Ep.3](#)

# Qiskit textbook

- For university quantum computation course
- Open source and collaborative
- Run algorithms with Qiskit
- Interactive on IBM Quantum Experience with one click



Ref: [Qiskit textbook](#)