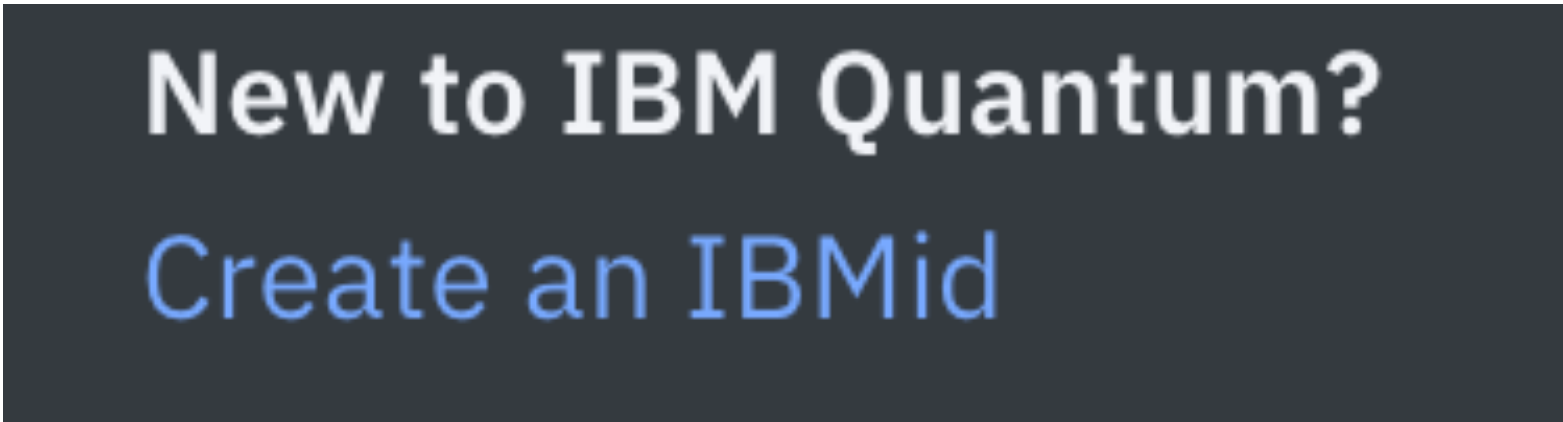


Preparation for hands-on exercise

Go to <https://quantum.ibm.com/>

If you don't have IBM account, please follow the instructions to create an IBMid



New to IBM Quantum?
[Create an IBMid](#)

Once you have the account, sign in to IBM Quantum

IBM Quantum Platform

API Token

.....

↺

📄

⋮

Recent jobs

[View all](#)

0

Pending

6705

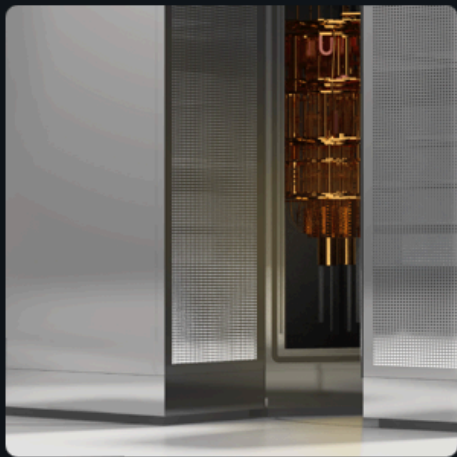
Completed jobs

Job ID	Status	Created	Completed	Compute resource
cqdxtnjgepgg008fc860	⌚ Cancelled	About 12 hours ago	About 12 hours ago	ibm_cusco
cqdxk8xfejeg0085x230	✅ Completed	About 13 hours ago	About 13 hours ago	ibm_cusco
cqdxeargtagg008qrgrs0	✅ Completed	About 13 hours ago	About 13 hours ago	ibm_cusco
cqd7rpaxdecg008w5s1g	⌚ Cancelled	1 day ago	1 day ago	ibm_cusco
cqd4hfnxftxg00897bx0	⌚ Cancelled	1 day ago	1 day ago	ibm_cusco

Instance systems

→

12



Simulators

→

5

Documentation

[Open app](#)

Search docs



Hello World

Create a simple quantum program and run it on a quantum system

Qiskit Runtime

Introduction to primitives

Learning

[Open app](#)

Catalog

New

Explore all courses and tutorials

IBM Quantum Composer

Graphically build circuits



IBM Quantum Lab

Develop quantum experiments



What's new →

- Product update
Update to Qiskit Runtime Primitives
12 days ago • [Read more](#)
- Product update
Updates to Learning -- earn badges and explore the new Learning catalog!
3 months ago • [Read more](#)
- Product update
Introducing ibm_osaka, a new 127-qubit system
3 months ago • [Read more](#)
- Product update
Qiskit.org redirects and content migration
3 months ago • [Read more](#)
- Product update
Journey toward utility: a new 127-qubit system for Open plan users
3 months ago • [Read more](#)
- Product update
New URL strategy on IBM Quantum
3 months ago • [Read more](#)

IBM Quantum Platform

API Token

.....



Recent jobs

[View all](#)

0

Pending

6705

Completed jobs

Job ID	Status	Created	Completed
cqdxtnjgepgg008fc860	Cancelled	About 12 hours ago	About 12 hours ago
cqdxk8xfejeg0085x230	Completed	About 13 hours ago	About 13 hours ago
cqdxeargtagg008qrgs0	Completed	About 13 hours ago	About 13 hours ago
cqd7rpaxdecg008w5s1g	Cancelled	1 day ago	1 day ago
cqd4hfnxftxg00897bx0	Cancelled	1 day ago	1 day ago

What's new →

- Product update
Update to Qiskit Runtime Primitives
12 days ago • [Read more](#)

API Token

.....

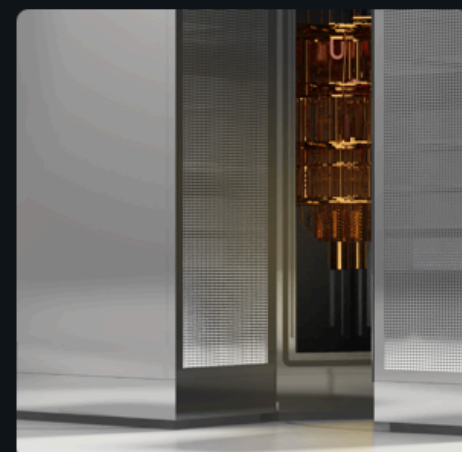


In case you need your API token,
you can copy it here

No need to do that if you use only
IBM Quantum Lab (next page)

Instance systems →

12



Simulators →

5

Documentation

[Open app ↗](#)

Search docs



Hello World

Create a simple quantum program and run
it on a quantum system

Qiskit Runtime

Introduction to primitives

Learning

[Open app ↗](#)Catalog **New**

Explore all courses and tutorials

IBM Quantum Composer
Graphically build circuits



IBM Quantum Lab
Develop quantum experiments



New URL strategy on IBM Quantum
3 months ago • [Read more](#)

IBM Quantum Platform

API Token

.....

↺

📄

⋮

Recent jobs View all

0

Pending

6705


Completed jobs

Job ID	Status	Created	Completed	Compute resource
cqdxtnjgepgg008fc860	⌛ Cancelled	About 12 hours ago	About 12 hours ago	ibm_cusco
cqdxk8xfejeg0085x230	✅ Completed	About 13 hours ago	About 13 hours ago	ibm_cusco
cqdxeargtagg008qrgs0	✅ Completed	About 13 hours ago	About 13 hours ago	ibm_cusco
cqd7rpaxdecg008w5s1g	⌛ Cancelled	1 day ago	1 day ago	ibm_cusco
cqd4hfnxftxg00897bx0	⌛ Cancelled	1 day ago	1 day ago	ibm_cusco

- What's new →
- Product update
Update to Qiskit Runtime Primitives
12 days ago • [Read more](#)
 - Product update
Updates to Learning -- earn badges and explore the new Learning catalog!
3 months ago • [Read more](#)
 - Product update
Introducing ibm_osaka, a new 127-qubit system
3 months ago • [Read more](#)
 - Product update
Qiskit.org redirects and content migration
3 months ago • [Read more](#)
 - Product update
Journey toward utility: a new 127-qubit system for Open plan users
3 months ago • [Read more](#)
 - Product update
New URL strategy on IBM Quantum
3 months ago • [Read more](#)

Instance systems →

12



Simulators →

5

Documentation Open app ↗

Search docs 🔍

Hello World

Create a simple quantum program and run it on a quantum system

Qiskit Runtime

Introduction to primitives

Learning Open app ↗

Catalog New

Explore all courses and tutorials

IBM Quantum Composer

Graphically build circuits

🔗

IBM Quantum Lab

Develop quantum experiments

📄🔗

We use IBM Quantum Lab in hands-on

Server not running

Your server is not running. Would you like to start it?

Launch Server



New file +



Filter files by name

Lab files /

Name ▲

Last Modified

Folder kmi-school-2024

3 days ago

Folder may4-challenge

4 years ago

Folder qc-workbook-lecturenotes

a year ago

Folder qc-workbook-lecturenotes...

2 years ago

Folder qc-workbook-lecturenotes...

2 years ago

File

Edit

View

Run

Kernel

Tabs

Settings

Help

Launcher



Notebook



Qiskit v1.0.0
(ipykernel)



Get started with
Grover's



Qiskit v1.0.0
(ipykernel)



Console



Qiskit v1.0.0
(ipykernel)

In each lecture, we will let you know a clickable link that allows you to upload the hands-on material to IBM Quantum Lab

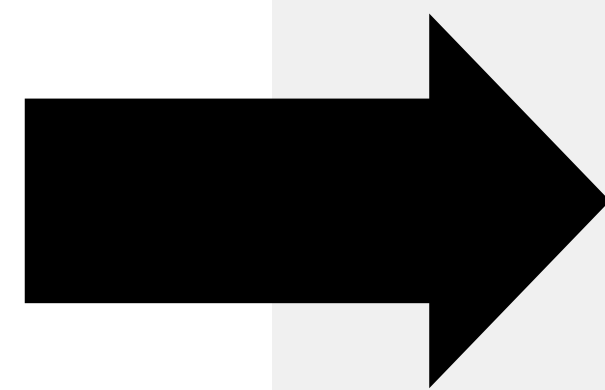
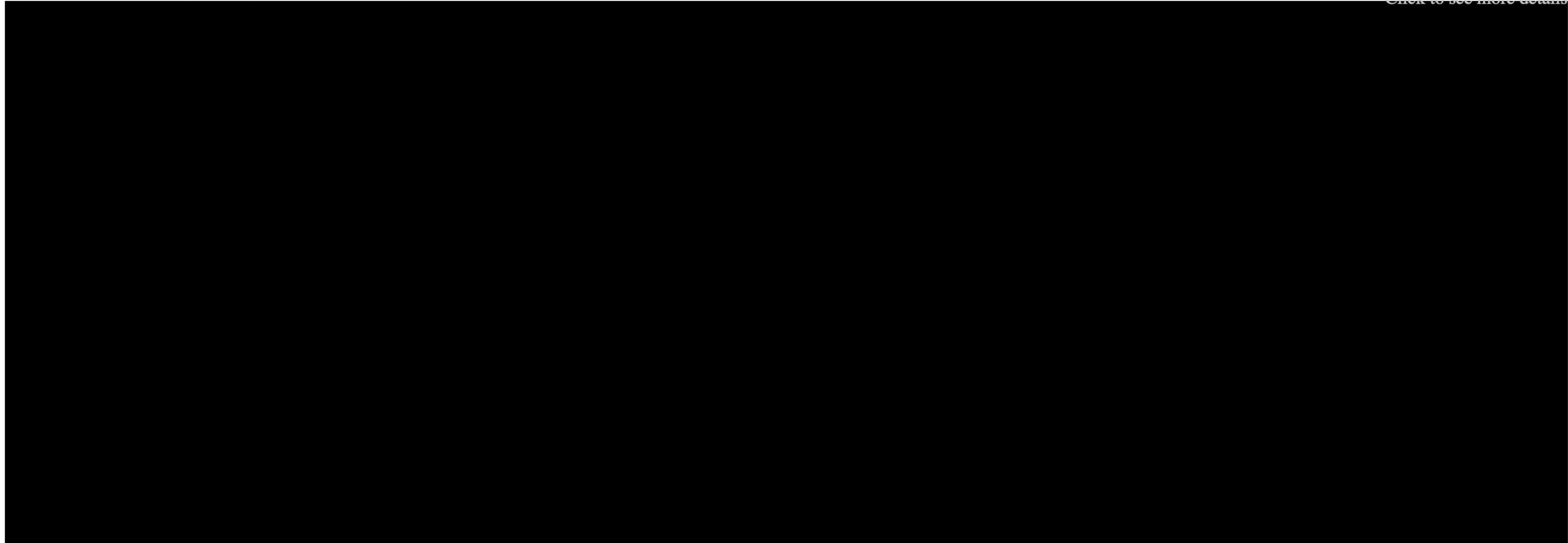
Something like a link below:

<https://bit.ly/3wvC54r>

shortened from the original one:

<https://lab.quantum-computing.ibm.com/hub/user-redirect/git-pull?repo=https%3A%2F%2Fgithub.com%2Fkterashi%2Fkmi-school-2024&urlpath=lab%2Ftree%2Fkmi-school-2024%2FLec1.ipynb&branch=master>

If you open the IBM Quantum Lab and click on the above link, then you will see...



This page should appear

IBM Quantum **Learning**

HomeCatalogNetworkComposerLab

Search iconUser iconShare iconGrid icon

Folder icon

New file +

Folder iconUp arrow iconRefresh icon

Search iconFilter files by name

Lab files / kmi-school-2024 /

Name ▲	Last Modified
Folder icon data	3 days ago
Folder icon ds	3 days ago
Folder icon hepqr	3 days ago
Folder icon qc_workbook	3 days ago
Image icon Lec1.ipynb	3 hours ago
Image icon Lec3.ipynb	12 hours ago

FileEditViewRunKernelTabsSettingsHelp

Lec1.ipynb × +

Save icon+ iconScissors iconCopy iconPaste iconPlay iconStop iconRefresh iconQiskit v1.0.0 (ipykernel) ○

Markdown ▾▶

Hands-on Exercise (1)

```
[1]: # Import everything
import sys
import numpy as np
import matplotlib.pyplot as plt
from IPython.display import Math
from qiskit import QuantumCircuit, QuantumRegister, ClassicalRegister, transpile
#from qiskit.tools.monitor import job_monitor
from qiskit_aer import AerSimulator
from qiskit_ibm_provider import IBMProvider, least_busy

sys.path.append('/home/jovyan/kmi-school-2024')
from qc_workbook.show_state import statevector_expr
```


IBM Quantum Learning | Home Catalog Network Composer Lab

File Edit View Run Kernel Tabs Settings Help

Lec1.ipynb

Qiskit v1.0.0 (ipykernel)

Hands-on Exercise (1)

```
[1]: # Import everything
import sys
import numpy as np
import matplotlib.pyplot as plt
from IPython.display import Math
from qiskit import QuantumCircuit, QuantumRegister, ClassicalRegister, transpile
#from qiskit.tools.monitor import job_monitor
from qiskit_aer import AerSimulator
from qiskit_ibm_provider import IBMProvider, least_busy

sys.path.append('/home/jovyan/kmi-school-2024')
from qc_workbook.show_state import statevector_expr
```

Lab files / kmi-school-2024 /

Name	Last Modified
data	3 days ago
ds	3 days ago
hepqpr	3 days ago
qc_workbook	3 days ago
Lec1.ipynb	3 hours ago
Lec3.ipynb	12 hours ago

Jupyter notebook for hands-on
Double-click to open in the right window

The screenshot shows the Qiskit IDE interface. At the top is a menu bar with 'File', 'Edit', 'View', 'Run', 'Kernel', 'Tabs', 'Settings', and 'Help'. Below the menu bar is a tab bar with a single tab labeled 'Lec1.ipynb'. Under the tab bar is a toolbar with icons for saving, adding a new file, undo, redo, running a cell, and other Jupyter Notebook functions. The main area of the IDE displays a Jupyter Notebook cell with the title 'Hands-on Exercise (1)'. The cell contains a code block with the following Python code:

```
[1]: # Import everything
import sys
import numpy as np
import matplotlib.pyplot as plt
from IPython.display import Math
from qiskit import QuantumCircuit, QuantumRegister, ClassicalRegister, transpile
#from qiskit.tools.monitor import job_monitor
from qiskit_aer import AerSimulator
from qiskit_ibm_provider import IBMProvider, least_busy

sys.path.append('/home/jovyan/kmi-school-2024')
from qc_workbook.show_state import statevector_expr
```

To the right of the code block, there is a large text overlay that reads: 'Select cell and click on or Shift+Enter'. A play button icon is visible next to the text.

10

Quantum Computing Workbook

We have been preparing an English version of Quantum Computing Workbook developed by ICEPP

Go to <https://utokyo-icepp.github.io/qc-workbook/en>

Several topics still missing in English version
Working in progress...