

```

#Demo Entanglement of two qubits

# Install Qiskit if not already installed
!pip install qiskit matplotlib qiskit_aer

# Install with: pip install qiskit qiskit-aer
from qiskit import QuantumCircuit
from qiskit_aer import Aer
from qiskit.visualization import plot_histogram
from qiskit.visualization import plot_bloch_multivector

# 1. Create a Quantum Circuit with 2 qubits and 2 classical bits
qc = QuantumCircuit(2, 2)

fig_0 = plot_bloch_multivector(qc, title="Initial States", reverse_bits=False)
display(fig_0)

# 2. Put the first qubit into superposition (50% chance of 0 or 1)
qc.h(0)

fig_1 = plot_bloch_multivector(qc, title="After Hadamard Gate on First Qubit", reverse_bits=False)
display(fig_1)

# 3. Entangle the first qubit with the second qubit
# This CNOT gate flips the second qubit ONLY if the first is 1
qc.cx(0, 1)

fig_2 = plot_bloch_multivector(qc, title="After CNOT gate", reverse_bits=False)
display(fig_2)

# 4. Measure both qubits and store results in classical bits
qc.measure([0, 1], [0, 1])

# 5. Simulate the circuit
backend = Aer.get_backend('qasm_simulator')
job = backend.run(qc, shots=1024)
result = job.result()

# 6. Show results (they will be either '00' or '11', never '01' or '10')
counts = result.get_counts()
print(f"Entanglement: Either 00 or 11")
print(f"Measurement outcomes: {counts}")

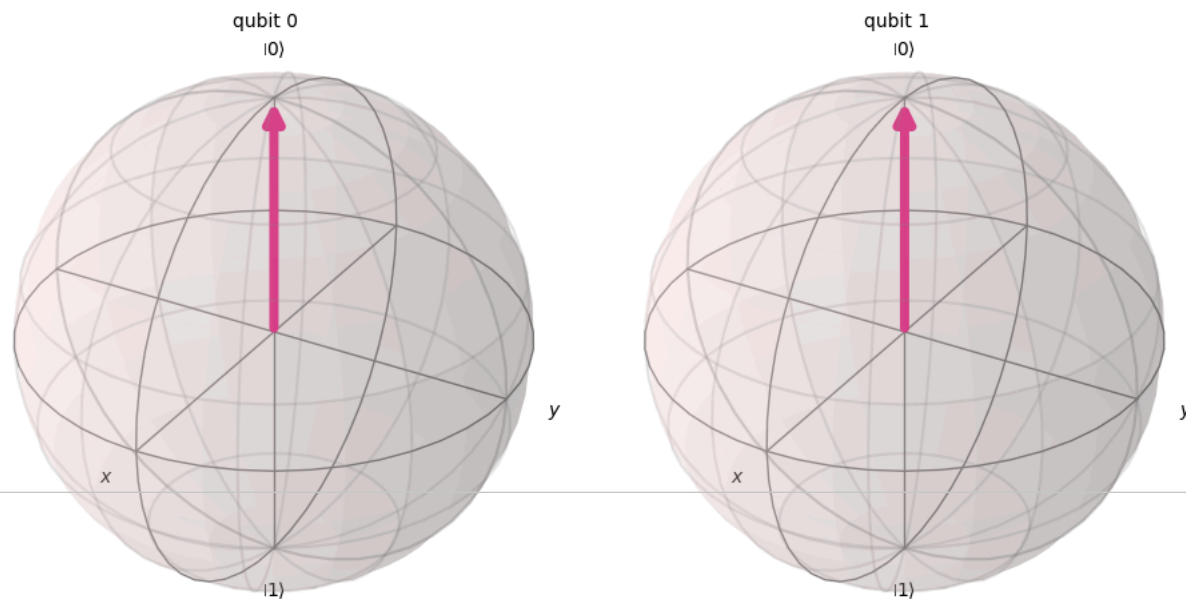
```

```

Collecting qiskit
  Downloading qiskit-2.4.1-cp310-abi3-manylinux_2_28_x86_64.whl.metadata (12 kB)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.12/dist-packages (3.10.0)
Collecting qiskit_aer
  Downloading qiskit_aer-0.17.2-cp312-cp312-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (8.3 kB)
Collecting rustworkx<=0.15.0 (from qiskit)
  Downloading rustworkx-0.17.1-cp39-abi3-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (10 kB)
Requirement already satisfied: numpy<3,>=1.21 in /usr/local/lib/python3.12/dist-packages (from qiskit) (2.0.2)
Requirement already satisfied: scipy>=1.5 in /usr/local/lib/python3.12/dist-packages (from qiskit) (1.16.3)
Requirement already satisfied: dill>=0.3 in /usr/local/lib/python3.12/dist-packages (from qiskit) (0.3.8)
Collecting stevedore>=3.0.0 (from qiskit)
  Downloading stevedore-5.8.0-py3-none-any.whl.metadata (2.3 kB)
Requirement already satisfied: typing-extensions in /usr/local/lib/python3.12/dist-packages (from qiskit) (4.15.0)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (1.3.3)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (4.63.0)
Requirement already satisfied: kiwisolver>=1.3.1 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (1.5.0)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (26.2)
Requirement already satisfied: pillow>=8 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (11.3.0)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (3.3.2)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (2.9.0.post0)
Requirement already satisfied: psutil>=5 in /usr/local/lib/python3.12/dist-packages (from qiskit_aer) (5.9.5)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.12/dist-packages (from python-dateutil>=2.7->matplotlib) (1.17.0)
Downloading qiskit-2.4.1-cp310-abi3-manylinux_2_28_x86_64.whl (9.3 MB)
 9.3/9.3 MB 120.4 MB/s eta 0:00:00
Downloading qiskit_aer-0.17.2-cp312-cp312-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (12.4 MB)
 12.4/12.4 MB 122.4 MB/s eta 0:00:00
Downloading rustworkx-0.17.1-cp39-abi3-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (2.2 MB)
 2.2/2.2 MB 110.0 MB/s eta 0:00:00
Downloading stevedore-5.8.0-py3-none-any.whl (54 kB)
 54.6/54.6 kB 5.1 MB/s eta 0:00:00
Installing collected packages: stevedore, rustworkx, qiskit, qiskit_aer
Successfully installed qiskit-2.4.1 qiskit_aer-0.17.2 rustworkx-0.17.1 stevedore-5.8.0

```

Initial States



After Hadamard Gate on First Qubit