Quantum Teleportation:

Quantum State to be teleported!

ψ

Sender!

Ram's Lab

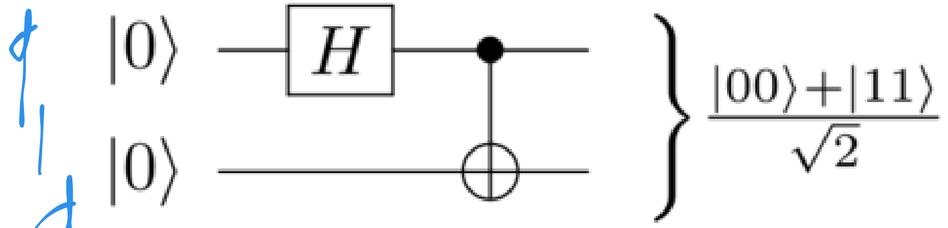
Entangled!!!!!

Receiver!

Shyam's Lab

Quantum Teleportation:

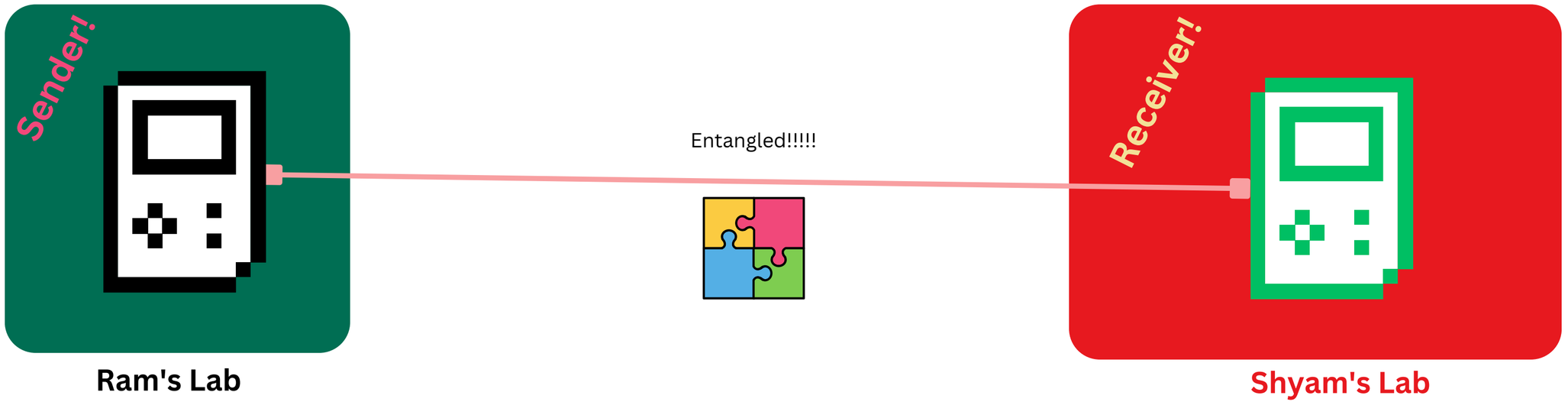
Step 1: Entangle Ram's & Shyam's Qubits



(Bell Pair)

Why?

We need to make a secure connection line first!



quantum-computing.ibm.com/composer/files/9db8a3769fbcad2d595dc56d5edee0a63a137c74974104596ef91c6da35fc02a

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IBM Quantum | Composer

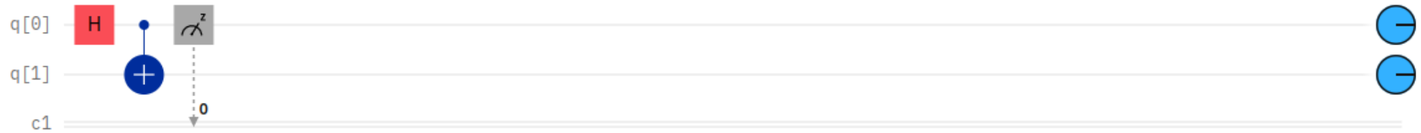
Phase Estimation Circuit (+) *Saved* | File | Edit | View | Visualizations seed 5168 | Setup and run

Operations

Classical
- NOT
- CNOT
- Toffoli
- SWAP
- Identity

Phase
- T
- S
- Z
- Tdg
- Sdg
- Phase

Left alignment | Inspect

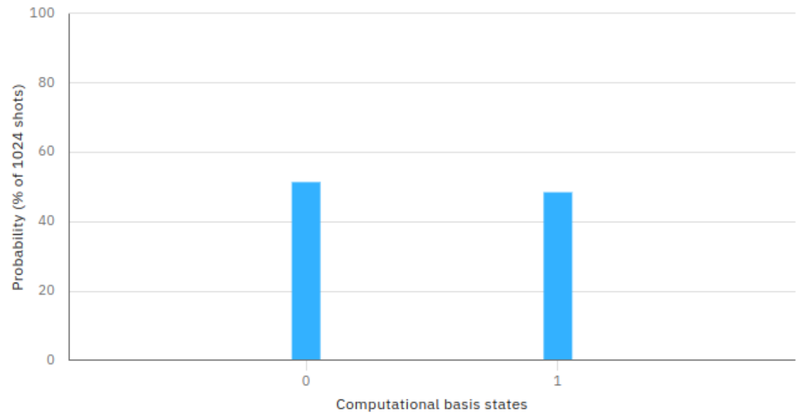


Qiskit | Read only

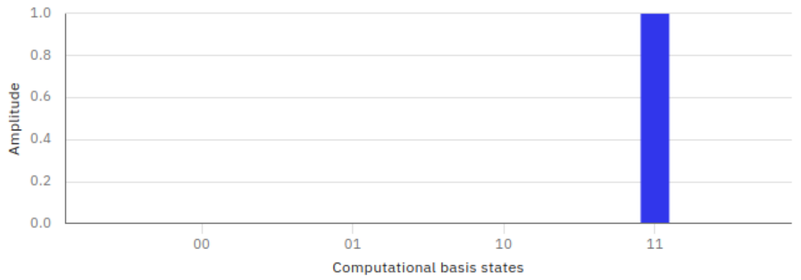
Open in Quantum Lab

```
1  from qiskit import
   QuantumRegister,
   ClassicalRegister, QuantumCircuit
2  from numpy import pi
3
4  qreg_q = QuantumRegister(2, 'q')
5  creg_c = ClassicalRegister(1,
   'c')
6  circuit = QuantumCircuit(qreg_q,
   creg_c)
7
8  circuit.h(qreg_q[0])
9  circuit.cx(qreg_q[0], qreg_q[1])
10 circuit.measure(qreg_q[0], creg_c
   [0])
```

Probabilities



Statevector

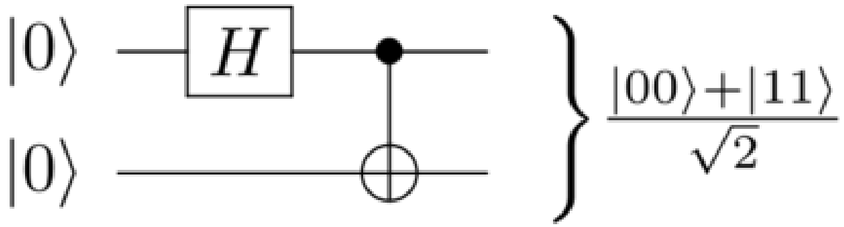


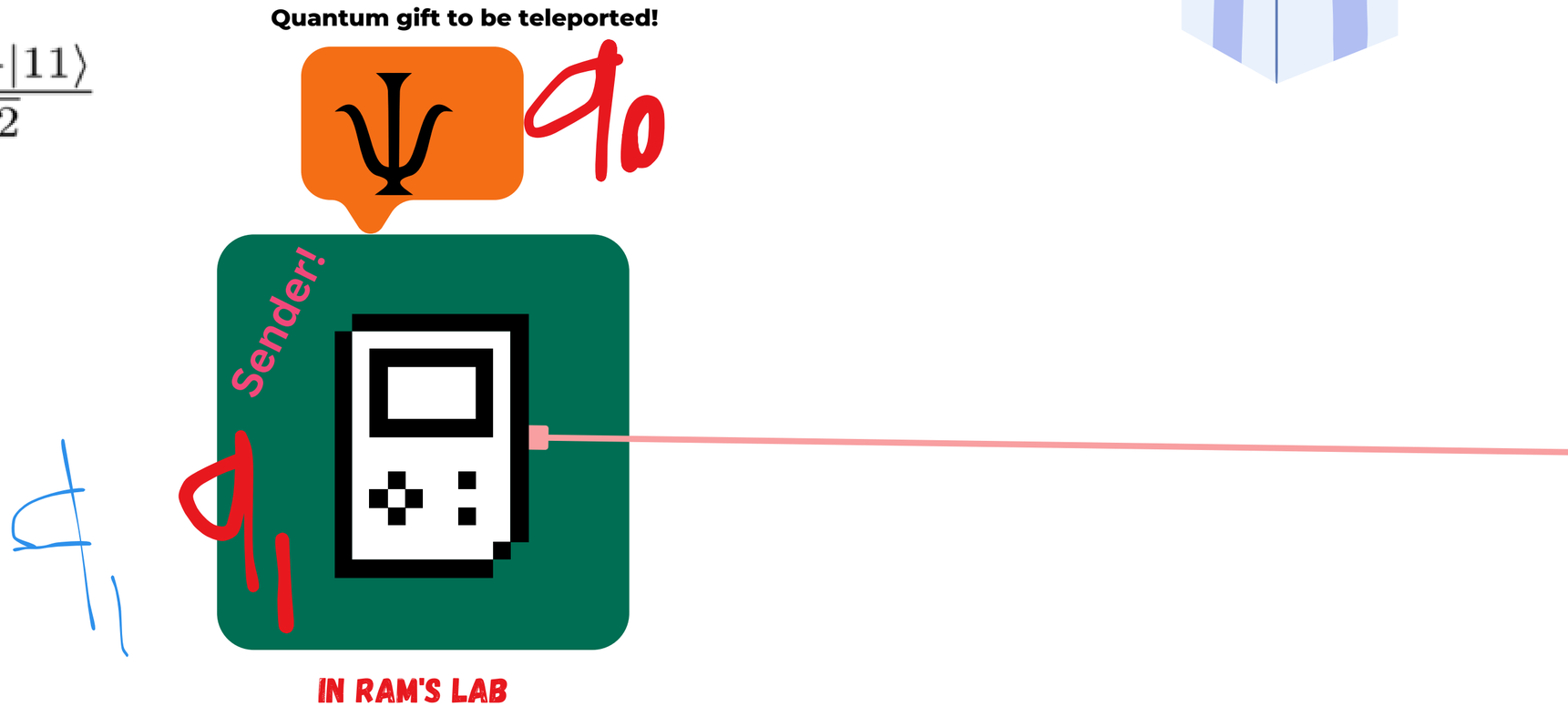
Output state

```
[ 0+0j, 0+0j, 0+0j, 1+0j ]
```

Quantum Teleportation:

Step 2: Entangle teleporting "Quantum Gift" with the Ram's Lab

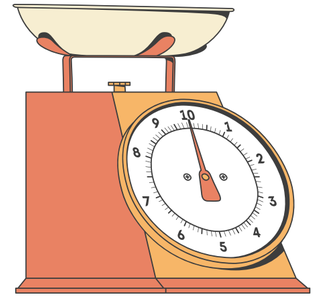


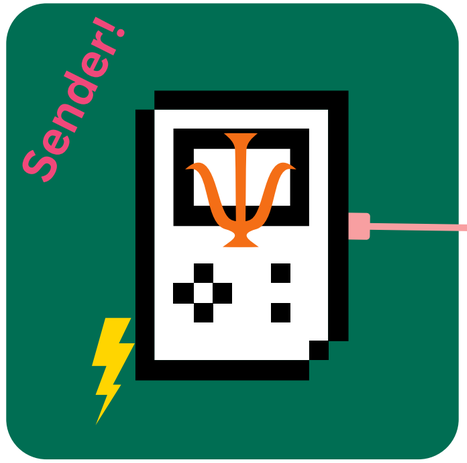


Quantum Teleportation:

Step 3: Measure teleporting "Quantum Gift" in Ram's Lab

Ram measures his half of "the Bell Pair"; measured values stored in a Classical Register

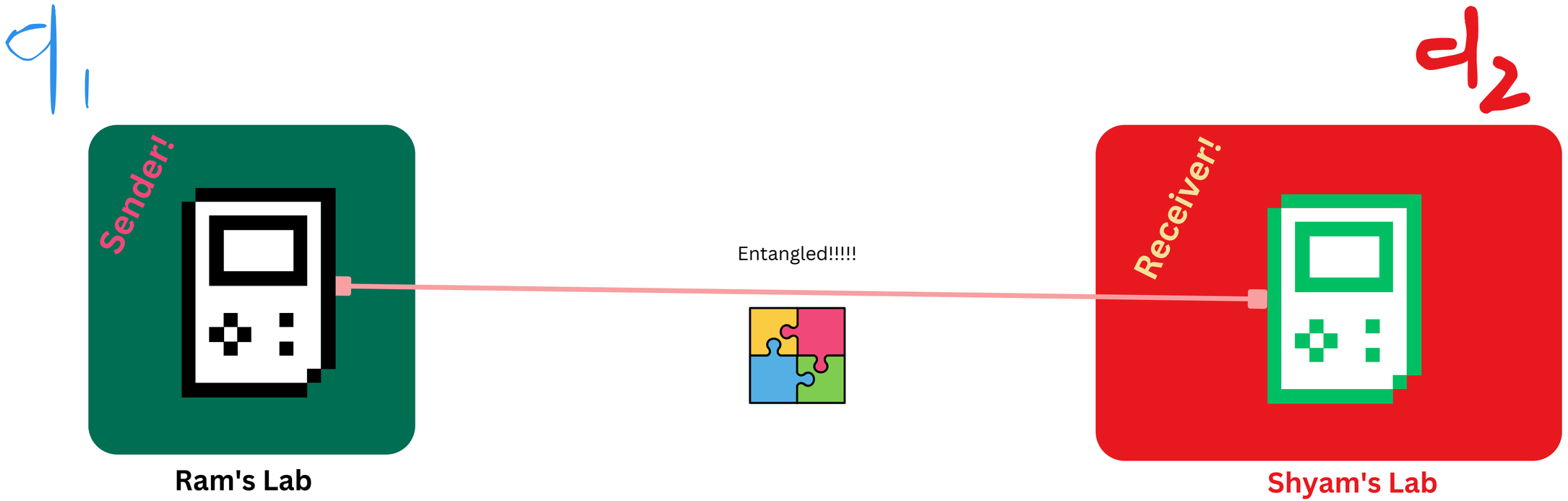




IN RAM'S LAB

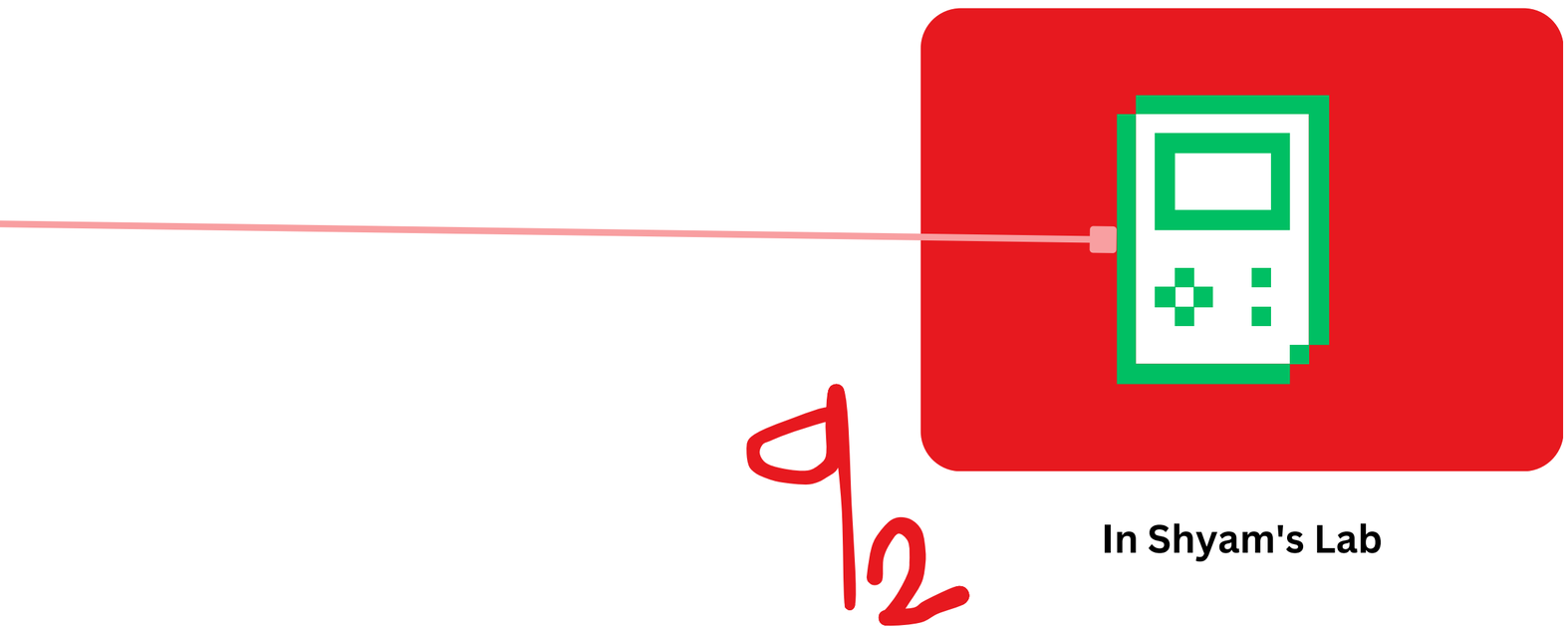
Quantum Teleportation:

Step 4: Use of Classical Channel to let Shyam know about the outcome!
(Secure Key!!!)



Quantum Teleportation:

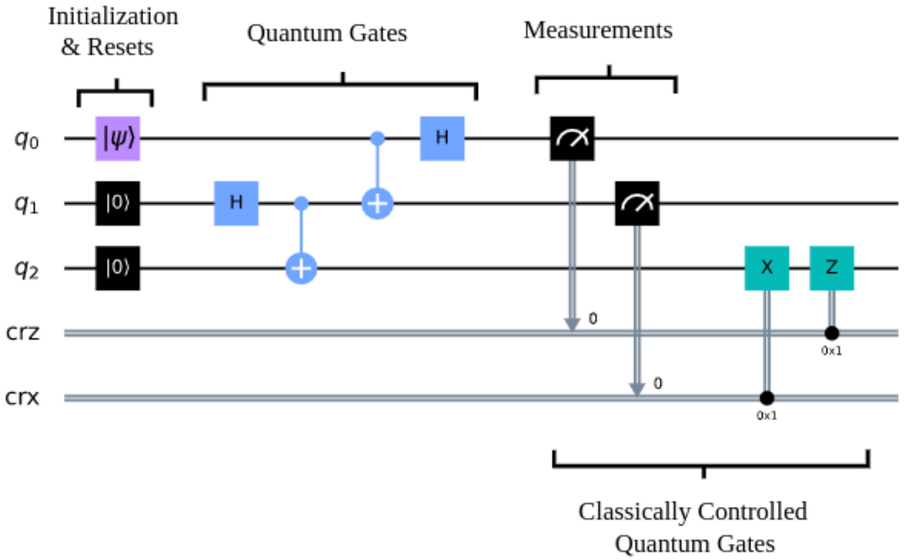
Step 4: Use the Key (Apply proper gates to the Shyam's Qubit) - then, measurement **the Shyam's Qubit**!!!!



In Shyam's Lab

3. Example: Quantum Teleportation

Take a look at the quantum circuit below. You will learn later in this chapter that it implements the quantum teleportation algorithm. For now, it suffices to look at the components of the quantum circuit.



The quantum circuit uses three qubits and two classical bits. There are four main components in this quantum circuit.

https://learn.qiskit.org/course/ch-algorithms/quantum-circuits