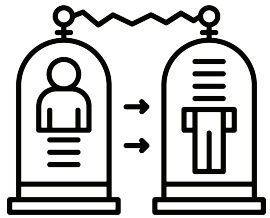
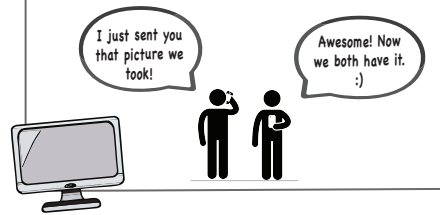


# QUANTUM TELEPORTATION



## COPYING BITS & QUBITS

CLASSICAL BITS ARE EASILY COPIED  
(That's how computers calculate things!)



IT'S NOT SO EASY FOR QUANTUM COMPUTERS!

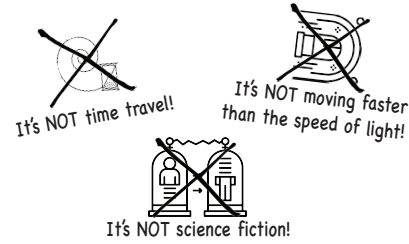
The NO-CLONING RULE:  
A qubit's state cannot be copied to another qubit - without changing the original.

I'm just one of a kind!



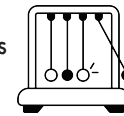
## QUANTUM TELEPORTATION

A protocol to move quantum information from one location to another location.



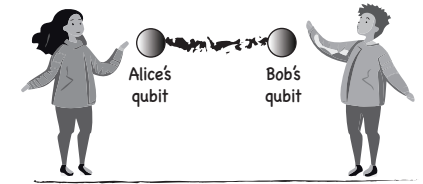
Quantum Teleportation makes it possible to transfer a qubit's complex state to another qubit.

It's a bit like how in Newton's cradle, the balls transfer their movement to each other.



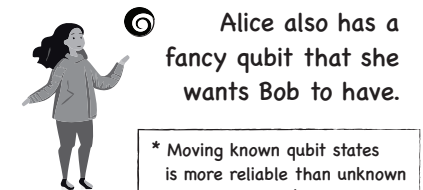
## HOW DOES QUANTUM TELEPORTATION WORK?

STEP 1: Alice entangles two qubits and sends one of them to Bob.\*  
(Bob can be nearby or far away.)



ALICE

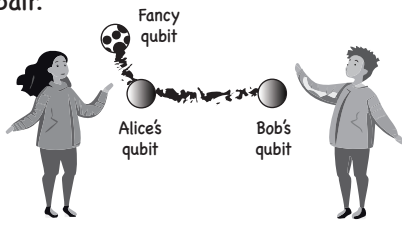
BOB



Alice also has a fancy qubit that she wants Bob to have.

\* Moving known qubit states is more reliable than unknown states, like Alice's fancy qubit!

STEP 2: Alice entangles the fancy qubit with her half of the entangled pair.

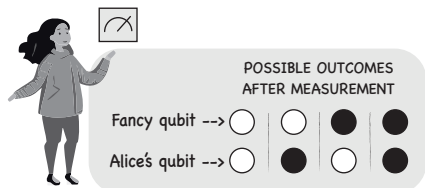


STEP 4: Alice uses classical bits to send her measurements to Bob.



STEP 3: Alice measures her qubits.

(She no longer has a fancy qubit, and her qubits are no longer entangled with Bob's.)



STEP 5: Bob uses this information to adjust his qubit.



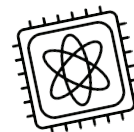
NOW, BOB HAS THE FANCY QUBIT!

## QUANTUM TELEPORTATION: NECESSARY, NOT FICTION!

Why not just send the fancy qubit?  
- Sending measurements is faster  
- Sending entangled qubits can be done ahead of time & more reliably

This is how quantum computers move their qubits around to perform calculations!

I'm going places!



Without quantum teleportation, the capabilities of quantum computers would be much more limited!

## FIND MORE QUANTUM COMPUTING ZINES HERE:

<https://www.epiqc.cs.uchicago.edu/resources/>

Contributions by Sabine Salnave

April 2024

This work is funded in part by EPIQC, an NSF Expedition in Computing, under grant 1730449 & Q2Work under grant 2039745)

