Quantum Mechanics & Quantum Computation

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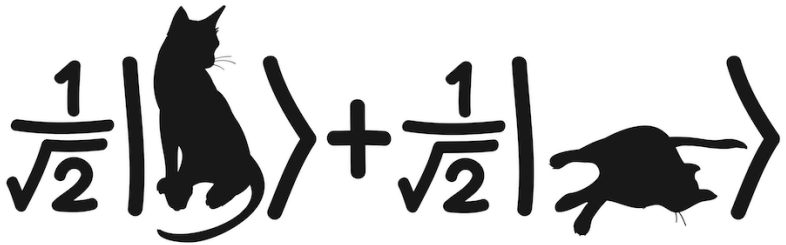
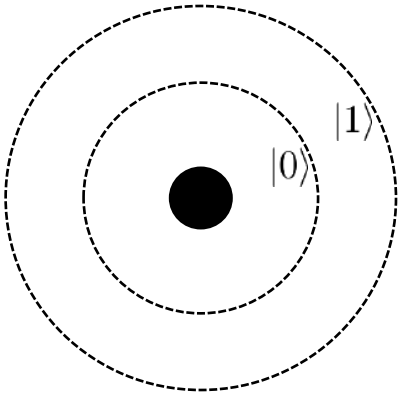


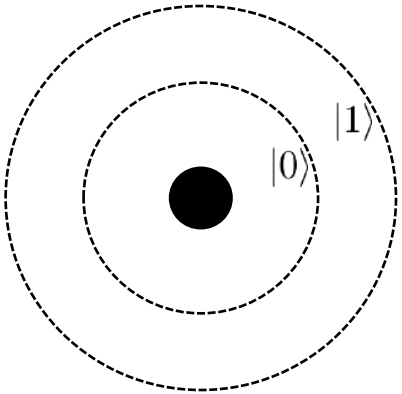
Lecture 3: Two Qubits & Entanglement

Entanglement

Composite System



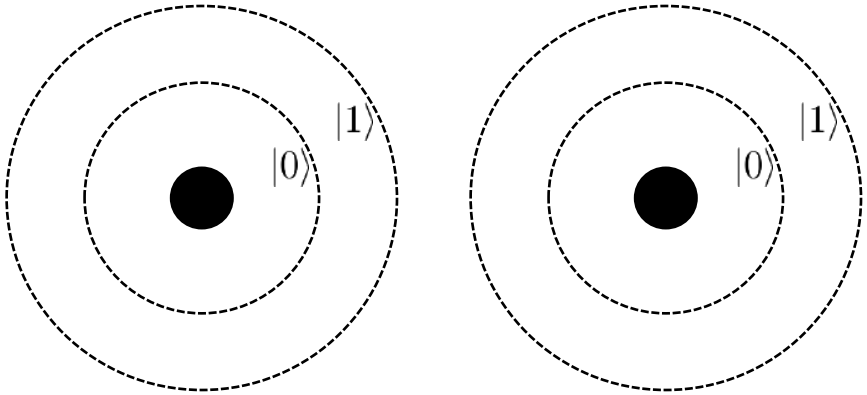
$\alpha_0|0\rangle + \alpha_1|1\rangle$



$\beta_0|0\rangle + \beta_1|1\rangle$

What is the state of the composite system?

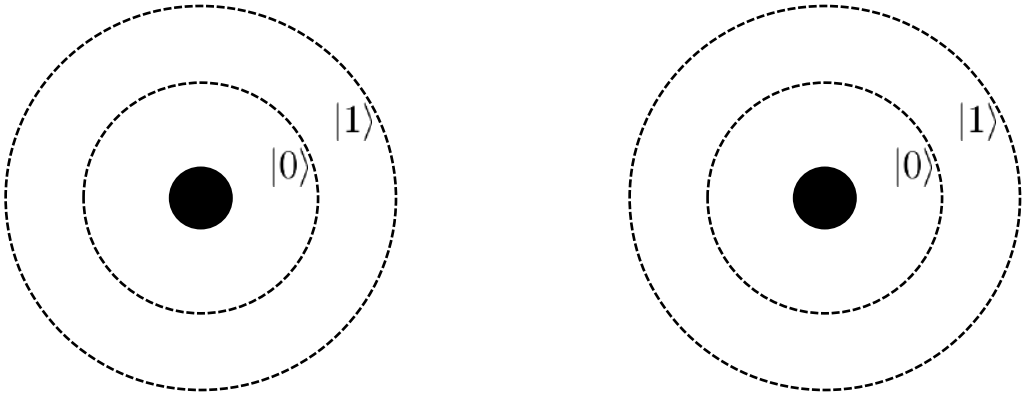
Given the state of the composite system, determiner the state of each qubit:



Can you always factorize the composite state?

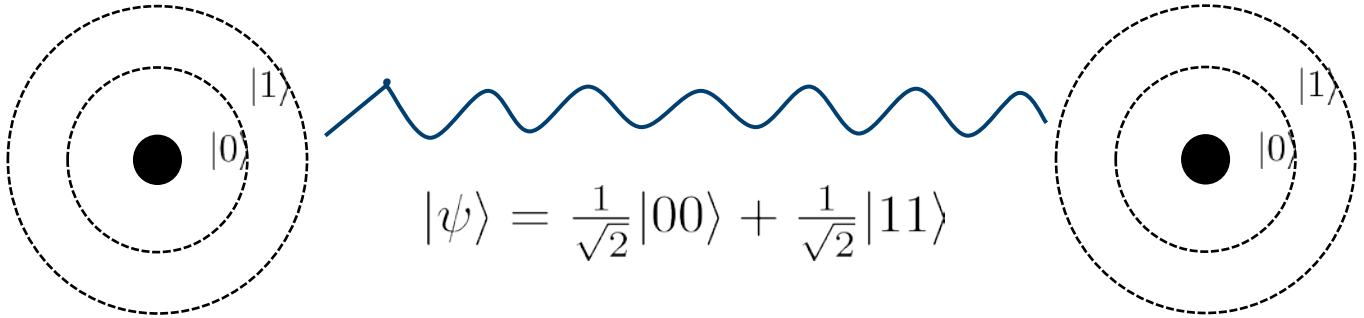
Answer: No!!

Bell State



$$|\psi\rangle = \frac{1}{\sqrt{2}}|00\rangle + \frac{1}{\sqrt{2}}|11\rangle$$

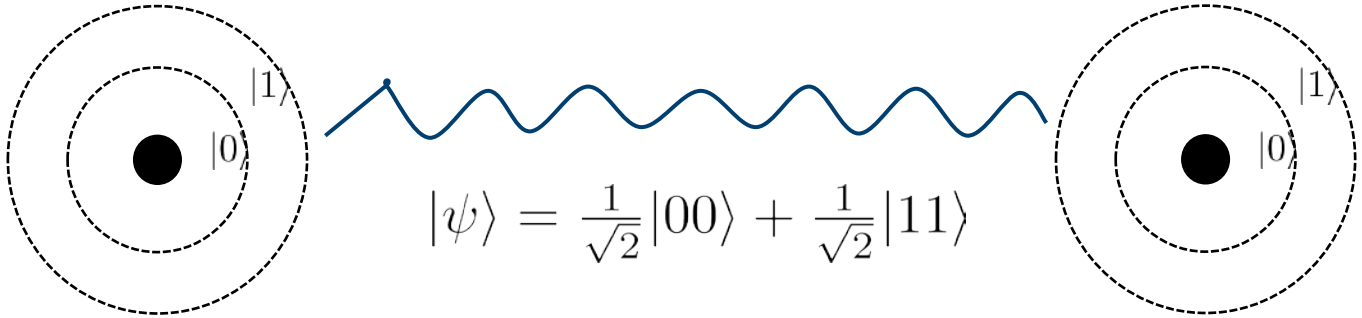
Measuring the Bell State



Measure first qubit: see 0 with probability ½ . New state = $|00\rangle$

see 1 with probability ½ . New state = $|11\rangle$

Measuring the Bell State



Measure first qubit: see 0 with probability ½ . New state = $|00\rangle$

see 1 with probability ½ . New state = $|11\rangle$

Same result if two particles share a coin flip before they were separated!