

Partial Trace

let's say you have 2 quantum states in a system



what is "trace"?
 $\text{Tr}[\rho]$ ← it is the sum of diagonal elements

if wanted just the density matrix for "A" you can eliminate ~~B~~ which is called "tracing out" B. Then you would have the density matrix for just A $\rightarrow \rho_A$ called the reduced states

Ex: $\rho_{AB} = \frac{1}{2} [|0\rangle\langle 0|_A \otimes |0\rangle\langle 0|_B + |1\rangle\langle 1|_A \otimes |1\rangle\langle 1|_B]$

↓ reduced state "A" ↑ Bipartite state

$$\rho_A = \frac{1}{2} [|0\rangle\langle 0|_A + |1\rangle\langle 1|_A]$$

Ex: Tripartite State

$$\rho_{ABE} = \frac{1}{2} [|0\rangle\langle 0|_A \otimes |0\rangle\langle 0|_B \otimes |0\rangle\langle 0|_E + |1\rangle\langle 1|_A \otimes |EPR\rangle\langle EPR|_{BE}]$$

$$\rho_B = \frac{1}{2} |0\rangle\langle 0|_B + \frac{1}{2} ? \text{ difficult b/c entangled BE}$$