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Tensor Network Theory

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We introduce some basic definitions and concepts of tensor network. We show that the tensor network can be used to represent quantum many-body states, where we explain MPS(Matrix Product States) in 1D and PEPS (Projected Entangled Pair States) in 2D systems, as well as the generalizations to thermal states and operators. The quantum entanglement properties of the tensor network states including the area law of entanglement entropy also be discussed. Finally, we present several special tensor network's that can be exactly contracted, and demonstrate the difficulty of contracting tensor network's in general cases.

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