# Characterizing and Observing Quantum Multipartite Entanglement

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Quantum entanglement plays a crucial role in the emerging dynamics of quantum systems, which is particularly true for quantum many-body systems. Understanding quantum multipartite entanglement is thus essential to fully capture the physical properties of quantum systems and to identify their potential applications in various contexts. In this talk, we present several approaches to address quantum multipartite entanglement in the contexts of quantum simulation and quantum metrology. Those tools can be useful to identify and observe a hierarchy of quantum multipartite entanglement *e.g.* manifesting the quantum phase transitions of atoms in optical lattices and the quantum metrological power of quantum network.