Entanglement entropy in non-abelian anyonic systems

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Entanglement is an important resource for quantum information protocols such as quantum teleportation. In a topological phase, entanglement entropy has a characteristic term called “topological entanglement entropy” which depends on the quantum dimension of anyons. However, operational meaning of topological entanglement entropy is not known.

We study the operational meaning of entanglement entropy in anyonic systems to treat entanglement as a resource for a protocol. We show that in non-abelian anyonic systems, entanglement entropy is superadditive in terms of number of state copies. The nontrivial contribution to entanglement entropy, caused by superadditivity, is asymptotically equal to the topological entanglement entropy derived by the method of topological quantum field theory [1]. We also show that this contribution serves as a resource for an entanglement distillation protocol.