Scalable dissipative preparation of many-body entanglement

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Entanglement is an essential resource for quantum information, quantum computation and quantum communication. While small entangled states of few particles have been used to demonstrate non-locality of nature and elementary quantum communication protocols, more advanced quantum computation and simulation tasks as well as quantum-enhanced measurements require many-body entanglement. Over the past years, impressive progress has been made on entangling larger numbers of qubits using unitary quantum gates. Entangled states are, however, sensitive to interactions with the environment, which are present in any open system. In particular decoherence and dissipation have remained a challenge. Here we show that by taking an approach alternative to quantum gates one can actively use dissipation to generate many-body entanglement. We demonstrate that by adding sources of dissipation and engineering decay processes, multi-particle entangled states can be prepared efficiently as steady states of the dissipative time evolution. Our protocols pave the way for the dissipative production of many-body entanglement in physical systems such as trapped ions.

- Quantum Information Theory [2]
- Result [3]
- SIQS [4]
- 04.70.+m Multi-particle/multi-photon entanglement [5]

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