Dissipative production of a maximally entangled steady state

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Reference:
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URL:
http://arxiv.org/abs/1307.4443 [2]

Entangled states are a key resource in fundamental quantum physics, quantum cryp-tography, and quantum computation [1].To date, controlled unitary interactions applied to a quantum system, so-called "quantum gates", have been the most widely used method to deterministically create entanglement [2]. These processes require high-fidelity state preparation as well as minimizing the decoherence that inevitably arises from coupling between the system and the environment and imperfect control of the system parameters. Here, on the contrary, we combine unitary processes with engineered dissipation to deterministically produce and stabilize an approximate Bell state of two trapped-ion qubits independent of their initial state. While previous works along this line involved the application of sequences of multiple time-dependent gates [3] or generated entanglement of atomic ensembles dissipatively but relied on a measurement record for steady-state entanglement [4], we implement the process in a continuous time-independent fashion, analogous to optical pumping of atomic states. By continuously driving the system towards steady-state, the entanglement is stabilized even in the presence of experimental noise and decoherence. Our demonstration of an entangled steady state of two qubits represents a step towards dissipative state engineering, dissipative quantum computation, and dissipative phase transitions [5-7]. Following this approach, engineered coupling to the environment may be applied to a broad range of experimental systems to achieve desired quantum dynamics or steady states. Indeed, concurrently with this work, an entangled steady state of two superconducting qubits was demonstrated using dissipation [8].

- QIPC [3]
- FP7 [4]
- Quantum Computation [5]
- Highlight [6]
- Result [7]
- SIQS [8]
- 18.80.+d Quantum dissipative systems [9]

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