1 Introduction

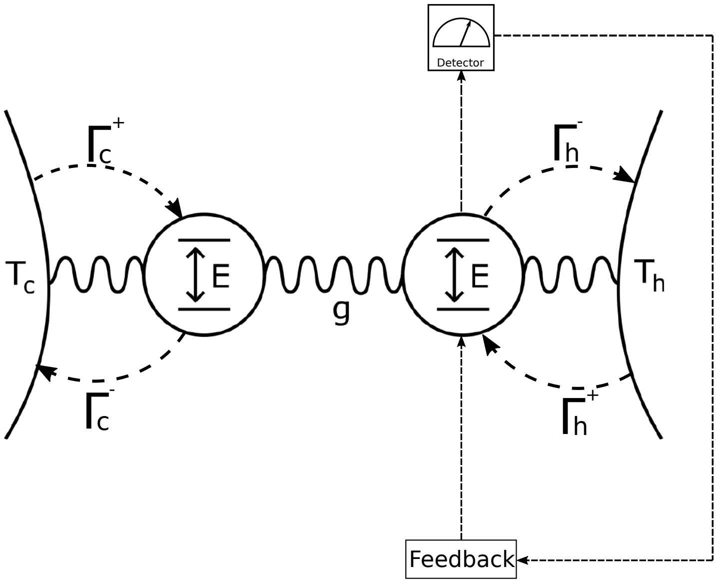

Figure 1: A schematic example of the considered systems. Here, two coupled qubits connected to two separate bosonic/fermionic thermal reservoirs and a measuring device is set to continuously monitor properties of the hot system. Already in the absence of feedback, such system has been shown to be capable of presenting steady state entanglement.

The purpose of this study is to explore how the generation of entanglement in thermal machines can be manipulated using measurement based feedback control. The studied thermal machines are comprised of two coupled qubits, connected to two separate thermal baths (bosonic or fermionic), as shown in Fig. 1. For these simple thermal machines, previous studies have demonstrated the efficacy of incoherent system-bath interactions to generate steady state entanglement [1, 2, 3]. In this thesis, we intend continuously monitor the system and use the extracted information to generate useful feedback protocols apt to generate additional entanglement. One of the key aspects of this study is the use of a newly developed formalism for feedback control [4] that generalizes the Milburn equation [5] to include the detector's bandwidth and an arbitrary dependence on the measurement outcome.

In the limit of an infinitely fast detector with infinite measurement strength, we obtain results capable of generating entanglement between three (fermionic case) to seven (bosonic case) times the amount of entanglement established in previous studies. Lastly, to understand the usefulness of the generated entanglement, we study its ability to perform purely non-classical tasks, such as teleportation and violation of the CHSH Bell-inequality.

References

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