Gaussification and entanglement distillation of continuous variable systems: a unifying picture

Thu, 2011-10-13 15:48 - Q-Essence Coordinator [1] **Date:** 2011-06-07
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Reference:
arXiv:1107.1406

URL:
http://xxx.lanl.gov/abs/1107.1406 [2]

Distillation of entanglement using only Gaussian operations is an important primitive in quantum communication, quantum repeater architectures, and distributed quantum computing. Existing distillation protocols for continuous degrees of freedom are only known to converge to a Gaussian state when measurements yield precisely the vacuum outcome. In sharp contrast, non-Gaussian states can be deterministically converted into Gaussian states while preserving their second moments, albeit by usually reducing their degree of entanglement. In this work - based on a novel instance of a non-commutative central limit theorem - we introduce a picture general enough to encompass the known protocols leading to Gaussian states, and also demonstrate convergence for a class of new protocols. This gives the experimental option of balancing the merits of success probability against entanglement produced. The generality of results also opens up entirely new territory, by providing means of multi-partite distillation and more efficient hybrid quantum repeater schemes.

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