# Resource Theory in two-mode Gaussian Open Systems

Serban Suciu[1] and Aurelian Isar[1]

[1] National Institute of Physics and Nuclear Engineering, P.O.Box MG-6, Bucharest-Magurele, Romania

**Abstract**

We apply resource theory to quantum open systems, which allows us to define simple measures for quantum resources. Using these, we compute the evolution of quantum correlations for a system consisting of two non-interacting and non-resonant bosonic modes, embedded in a thermal environment.

Progress in the development of quantum information theory came from a resource theory approach to quantum entanglement. When restricted to local operations and classical communication (LOCC), entanglement can be regarded as a resource for quantum information processing tasks. An active field of research is the extension of this framework to general quantum correlations such as discord and coherence. Most work however is restricted to the discrete case, leaving out continuous variable systems necessary for quantum optics.

A framework for analyzing resource theories is based on so called resource destroying maps [1]. This class of maps leave resource-free states unchanged but erase the resource stored in all other states. They can be used to define a class of simple resource measures that can be calculated without optimization, and that are monotone non-increasing under operations that commute with the resource destroying map.

In this sense, we apply the theory of resource destroying maps to the dynamics of two-mode Gaussian open systems, described by the Gorini-Kossakowski-Lindblad-Sudarshan (GKLS) quantum master equation [2, 3, 4]. Based on the theory of completely positive quantum dynamical semi-groups, GKLS gives a fully analytically solvable description of the irreversible time evolution of an open system.

Using measures that require no optimization, we compute the evolution of quantum coherence for a system consisting of two non-interacting and non-resonant bosonic modes, embedded in a thermal environment. Depending on the choice of resource destroying map and the geometry of the resource-free set, different measures for quantum information resources can be defined. We propose such a measure, based on Gibbs states.

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