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Semidefinite Programming and Quantum Resource Theories

One of the main goals of any resource theory such as entanglement, quantum thermodynamics, quantum coherence, and asymmetry, is to find necessary and sufficient conditions (NSC) that determine whether one resource can be converted to another by the set of free operations. In this talk I will present such NSC for a large class of quantum resource theories which we call affine resource theories (ARTs). ARTs include the resource theories of athermality, asymmetry, and coherence, but not entanglement. Remarkably, the NSC can be expressed as a family of inequalities between resource monotones (quantifiers) that are given in terms of the conditional min entropy. The set of free operations is taken to be (1) the maximal set (i.e. consists of all resource non-generating (RNG) quantum channels) or (2) the self-dual set of free operations (i.e. consists of all RNG maps for which the dual map is also RNG). As an example, I will discuss the applications of the results to quantum thermodynamics with Gibbs preserving operations, and several other ARTs. Finally, I will discuss the applications of these results to resource theories that are not affine.