Abstract

In a plethora of physical situations one can distinguish a mediator—a system that couples other, non-interacting systems. In this thesis, we analyze such scenarios from a quantum information theory standpoint by exploring the relation between correlations and mediated dynamics. We start with a unified description of various types of correlations in the context of resource theories. Then we concentrate on negativity, which is distinguished as one of the few computable entanglement monotones. We construct a hierarchy of distance-based correlation measures that are comparable to negativity. Then we study the correlations in two probes interacting via a mediator. We define classical interactions through commutativity of the interaction Hamiltonians. We propose methods to detect nonclassicality of the interaction solely through the correlations in the probes. Finally, we discuss applications of this formalism to restrict possible theories of gravity in a Hilbert space and to the theory of quantum simulators.