Abstract

The correlations generated by measuring quantum systems challenge classical paradigms and drive research in quantum information theory to identify and quantify nonclassical properties across various resources. This dissertation focuses on resources generated in Einstein-Podolsky-Rosen (EPR) scenarios and their generalizations. In a standard bipartite EPR scenario, nonclassical correlations are produced through local measurements on half of a system prepared in an entangled state. The nonclassical resource that arises in this scenario, called an *assemblage*, is an example of a common-cause resource where the correlations between parties arise through the shared system (without communication). In this dissertation, we study the nonclassicality of EPR assemblages through a series of three research papers [1, 2, 3].

In the first paper [1], we develop a resource theory of assemblages with local operations and shared randomness as the set of free operations. Within this framework, we investigate conversions between resources using semidefinite programming and resource monotones. The second paper [2] focuses on generalizations of the bipartite EPR scenario involving post-quantum resources. We introduce a resource theory for this case and analyze the pre-order among quantum and post-quantum resources both analytically and numerically. Finally, in the third paper [3], we examine the relationship between post-quantumness in EPR scenarios and Bell scenarios. We propose a protocol that transforms post-quantum EPR assemblages into a multipartite Bell-type scenario, resulting in post-quantum device-independent correlations.