

Some applications of free spectrahedra to quantum information theory

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I will discuss a surprising connection between some problems in quantum information theory and the theory of (free) spectrahedra. A spectrahedron is a slice of a positive semidefinite cone, which can be understood as a generalization of polytopes. A free spectrahedron is a matricization of a spectrahedron, more precisely a collection of matrix sets defined by linear matrix inequalities. We shall relate the problem of (free) spectrahedron inclusion to the problem of measurement compatibility in quantum mechanics. This surprising connection allows us to obtain optimal results about the robustness of incompatibility. Other inclusion problems will be related to different problems in quantum information theory, emphasizing the general idea that free convexity is a fundamental notion, with many applications in quantum theory.