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All inequalities for the relative entropy. (English) Zbl 1122.82003

Summary: The relative entropy of two $n$-party quantum states is an important quantity exhibiting, for example, the extent to which the two states are different. The relative entropy of the states formed by reducing two $n$-party states to a smaller number $m$ of parties is always less than or equal to the relative entropy of the two original $n$-party states. This is the monotonicity of relative entropy.

Using techniques from convex geometry, we prove that monotonicity under restrictions is the only general inequality satisfied by quantum relative entropies. In doing so we make a connection to secret sharing schemes with general access structures: indeed, it turns out that the extremal rays of the cone defined by monotonicity are populated by classical secret sharing schemes.

A surprising outcome is that the structure of allowed relative entropy values of subsets of multiparty states is much simpler than the structure of allowed entropy values. And the structure of allowed relative entropy values (unlike that of entropies) is the same for classical probability distributions and quantum states.

MSC:
82B10 Quantum equilibrium statistical mechanics (general)
81P68 Quantum computation
94A62 Authentication, digital signatures and secret sharing

Keywords:
relative entropy; monotonicity; convex geometry

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References: